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[OFFICIAL NOTICE.]

Twenty-second Annual Meeting, Western Gas Association.

WESTERN GAS ASSOCIATION, OFFICE OF THE SECRETARY,
NEW ALBANY, IND., May 10, 1899.

To the Members of the Western Gas Association:

The twenty-second annual meeting of the Western Gas Association will be held in Milwaukee, Wis., June 14, 15 and 16, 1899.

The meeting will be called to order by the President, Mr. George Treadway Thompson, at 9:30 A.M., Wednesday, June 14.

Mr. E. G. Cowdery, Chairman of the Committee of Arrangements, reports that the Hotel Pfister has been selected as headquarters, and that the meetings will be held in its banquet room.

Arrangements for the entertainment of the guests are not as yet wholly completed. Those that have been determined upon are as follows:

A reception to the gentlemen and ladies present will be given by Mr. Cowdery at his residence on Wednesday evening.

A banquet, to be provided by the Association, in which the ladies will participate, will be held on Thursday evening in the main dining room of the Hotel Pfister. Several novel features will be introduced on this occasion, which will, it is believed, add very materially to the entertainment of guests, and it is urged that members do not fail to provide themselves with tickets in advance.

Tickets for banquet will be sold at $5 each, and will entitle the holder to all privileges of the excursion which will be provided for Friday.

As it is necessary that arrangements for this banquet and excursion should be perfected at a very early date, it is requested that all those who expect to attend the meeting will purchase their tickets, or notify the Committee as early as possible of the number of tickets they will require.

The gas works, the E. P. Allis works, the breweries and other places of interest, all of which will be easily accessible by electric cars, will be open to the inspection of visitors during the week. A list of such places will be made up, with directions for finding same easily.

Accommodations can be secured at the following first-class hotels, all within five minutes' walk of the Pfister:

Hotel.	American Plan.	European Plan.
Hotel Pfister.....	$3.00 to $5.00	$1.50 to $3.50
Plankinton House.....	3.50 to 5.00	2.50 to 3.50
Hotel Davidson.....	....	2.50 to 3.50
St. Charles Hotel.....	2.00 to 3.00	....
Schlitz Hotel.....	....	1.00 to 1.50
Hotel Blatz.....	....	2.00 to 5.00

The Executive Committee has arranged for the presentation of the following papers:

"Causes Underlying the Formation of Naphthaline and their Prevention," by Mr. Paul Doty, Grand Rapids, Mich.

"Vitrified Clay Pipes Instead of Iron for Gas Mains," by Mr. Irvin Butterworth, Columbus, O.

"Furnishing Gas at Higher Pressure and without Leakage," by Mr. F. H. Shelton, Philadelphia, Pa.

"A Foundation That Failed and the Lesson It Taught," by Mr. B. E. Chollar, St. Louis, Mo.

"Cyanides in the Gas and Waste Products at Columbus, O.," by Mr. E. E. Eysenbach, Columbus, O.

"Problems in New Business: Some History and Experiments," by Mr. B. F. Wheeler, Binghamton, N. Y.

"Wrinkle Department," edited by Mr. E. H. Jenkins, Buffalo, N.Y.

"Report of Committee on Isolated Generators for Bench Firing," by Messrs. F. Bredel, Irvin Butterworth and W. E. Steinwedell, Committee.

The Western Passenger Association, from points in Eastern and Trans-Missouri territories, the Central Passenger Association, Trunk Line Association, Southeastern Passenger Association, the Wisconsin Central Lines, Chicago, Rock Island and Pacific Railway Company, the Chicago and Alton Road, have granted rates of one and one-third fare for the round trip, conditional on 100 certificates being presented to the Secretary for indorsement. The territory embraced by the above Associations includes all States east of the Mississippi River, except New England. The following States and Territories west of the Mississippi River are in the territory covered by the railway associations granting reduction: North Dakota, South Dakota, Minnesota, Iowa, Missouri, Nebraska, Kansas, Oklahoma, Indian Territory, Colorado and Utah.

All persons attending the meeting will purchase a first class ticket at starting point, paying full fare for same, obtaining from agent a certificate stating that the person whose signature appears on same has purchased, at full tariff fare, one first class ticket to Milwaukee, which certificate, after it has been signed by the Secretary of the Association and a representative of the above Passenger Association, will entitle the purchaser to a one-third rate returning home.

Apply to ticket agent at least 30 minutes before departure of train. All station agents do not have a supply of certificates, but they can be obtained by request, if notification is made in time. Persons outside the territory embraced by the Passenger Associations mentioned above should purchase a ticket to nearest point within one of said Association, and from there purchase a ticket to Milwaukee, obtaining a certificate which will, if properly endorsed in Milwaukee, entitle them to a one-

third fare returning to place from which certificate was obtained, provided it is endorsed by a representative of the Passenger Associations, who will be present at the meeting, and the undersigned.

Those who live in Western Passenger Association territory should consult local agents several days in advance of purchasing ticket to Milwaukee, in order to reach an understanding with the different roads as to the junction point via which they will make rates applicable. Some local agents sell to junction points, where delegates can rebuy to destination. Certificates held by wives of the delegates attending the meeting will be honored in the same manner as those held by the delegates themselves.

All queries sent the Secretary for the "Question Box" will be assigned to members for answers.

Mr. E. G. Pratt, of Des Moines, Iowa, is Chairman of the Committee on Extension of Membership, from whom, as well as any of the local committeemen, blank applications for membership can be obtained.

The Secretary will be pleased to answer any communication pertaining to the meeting, and will mail blank applications to any who desire to become members of the Association. JAMES W. DUNBAR, Secretary.

BRIEFLY TOLD.

ANNUAL MEETING, SOUTHWESTERN GAS, ELECTRIC AND STREET RAILWAY ASSOCIATION.—The annual meeting of the Southwestern Gas, Electric and Street Railway Association, which was unavoidably postponed from last month, will be held in Austin, Texas, Wednesday, Thursday and Friday of this week. The Secretary (Mr. E. L. Wells, Jr., of Marshall, Texas), informs us that all the preliminaries for a successful meeting have been attended to, and that, if expression of sentiment amounts to more than a mere forecast, a right good attendance is assured. The Driskill Hotel is to be headquarters, and President Drake's call to order is to be followed by an address of welcome from the Mayor of Austin—Mr. John D. McCall. Mr. Thos. D. Miller, of Dallas, will respond for the Association. Other ceremonial features of the first day are to be a reception at the capitol in the afternoon, the host being the Governor of the State—Mr. Joseph D. Sayers—and an informal reception in the evening, at the residence of President Drake. The remainder of the time allotted to diversion shows many ways and means of sensible enjoyment. The paper list carries 12 set articles, a very large number of which will be devoted to the electrical section of the Association's purposes; but four of the twelve are sure to be of interest to gas men, if one may so guess from titles. The hopeful ones are: "The Item of Depreciation," by Mr. W. E. Hamilton, of Shreveport, La.: "Meters," by Mr. W. E. Holmes, of Austin; "Art and Science of Selling Gas," by Mr. T. D. Miller, of Dallas; "The Attitude of a Corporation to the Public," by Mr. W. H. Weiss, of San Antonio. Take it altogether the Austin meeting of the Association promises much of benefit in every way to its members.

NO CHANGE IN THE NEW YORK WAR OF RATES.—The "financiers" contending for control of the gas supply of New York had not recovered their usual business caution up to the time of writing, so the war goes on. The Municipal Assembly took a hand in the fray by passing a resolution to the effect that the legal rate in the entire city should not exceed 75 cents per 1,000; but everybody who occupies the position of an onlooker considers that that is a badly aimed arrow at the Brooklyn Union Company. The whole affair would be ridiculous were it not for the unfortunate suspicion of suicide inseparable from a thoughtful consideration of the mess in which the "gas giants" have mixed themselves.

NOTES.—We regret to be called upon to report that Major Henry Bull died at his home in Newport, R. I., on the 6th inst. Deceased, who was in his 84th year (he was born in Newport, December 15, 1815), had been President of the Newport Gas Light Company since its organization in 1853. He was a graduate of Brown University, and subsequently engaged in the mercantile business with his father. He remained in trade until 1865. He is survived by four sons and a daughter. Of his next of kin it might not be amiss to state that one of them—W. T. Bull—enjoys a world-wide reputation as a surgeon and physician, while another—Melville Bull—represents the first Rhode Island District in the Congress of the United States. Further, if we mistake not, a third son—Chas. M. Bull—is President of the New York Coffee Exchange.——Another well-rounded, successful and admirable career was terminated last Thursday, when death came to Mr. David L. Bartlett, the senior member of the firm of Bartlett, Hayward & Co., of Baltimore. He was in his 84th year, and his life was that of a man amongst men.——The gas rate at Haverhill, Mass., has been fixed at $1 per 1,000 cubic feet.——There will be no consolidation of the Boston gas interests this year.

The Products of Combustion of Illuminating Gas.

The *Journal of Gas Lighting* publishes the following digest of a paper on the subject named in the heading, prepared by Professor Grehant for the French Society for the Encouragement of National Industry:

Coal gas is not without its dangers, though it is now so freely used on all sides. There is the danger of explosion of mixtures of coal gas and air. A notion of the violence of the explosion of such a mixture may be gained by exploding a mixture of 10 c.c. of gas and 58.6 c.c. of air—such being the theoretical proportions for complete combustion—in a bell glass immersed in water. Bearing in mind that a room 6½ feet square will contain about 100,000 times this quantity of such a mixture, it will be realized that the explosion may be practically irresistible.

Coal gas may be readily prepared on a small scale by heating coal in an iron tube which is closed at one end, and provided at the other end with a pipe for carrying off the gas. Lebon produced gas from wood and coal in 1786 in a similar manner; and a statue in the great gallery of the Conservatoire depicts him in the act of observing the flame of the coal gas he had prepared. The author exhibited photographs of this statue, and of the plant now employed for the industrial production of gas.

The powerful odor of coal gas favors the detection of leaks. A sample of purified coal gas, according to an analysis by Professor Schutzenberger, has the composition shown below, and the volumes of oxygen required for the combustion of the several components and the volumes of carbonic acid formed are also given:

Component Gases.	Volumes per Cent.	Volumes of Oxygen Consumed.	Volumes of Carbonic Acid Formed.
Hydrogen	45.6	22.8	..
Carbonic oxide	6.6	3.3	6.6
Carbonic acid	3.6	..	3.6
Methane	34.9	69.8	34.9
Ethylene	4.1	12.3	8.2
Butylene	2.3	13.8	9.2
	..	122.0	62.5

Thus 122 volumes of oxygen are needed to consume 100 volumes of coal gas; and about half that volume of carbonic acid is produced. Evidently, therefore, it is injurious to breathe the air, poor in oxygen and rich in carbonic acid, which is found above and about gas burners; and such contaminated air should be avoided. Whether the various types of burners produce carbonic oxide also is a more vexed question, which is about to be considered.

In the researches undertaken by the author, the following methods of estimating carbonic acid, oxygen and carbonic oxide were used.

Carbonic acid was estimated by bubbling the gas slowly through a long, slightly inclined tube charged with filtered baryta water. The rate of passage of the gas was controlled, and the volume of the gas was ascertained, by means of an aspirating bottle. The barium carbonate formed was subsequently decomposed in a vacuum by means of boiled dilute hydrochloric acid; and the volume of carbonic acid was measured. For example, suppose 1,500 volumes of gas were passed through the baryta water and yielded 12 volumes of carbonic acid, this amount of carbonic acid would be equivalent to 80 volumes in 10,000 volumes of the gas, or the gas would have contained 26 6 times as much carbonic acid as pure air contains.

Oxygen was estimated by exploding the gas or air containing it with hydrogen by means of a platinum wire rendered incandescent by the electric current. For example, suppose there were taken:

30.3 volumes of air vitiated by the combustion of gas.
46.9 " of vitiated air + hydrogen.
33 2 " remaining after the explosion
then 13.7 " equal the contraction on explosion
and $\frac{13.7}{3}$ " represent the oxygen present.

Hence 30.3 volumes of vitiated air contained $\frac{13.7}{3} = 4.566$ volumes of oxygen, or the air contained 11.07 per cent. of oxygen.

Carbonic oxide was estimated by a physiological method depending on the change which is effected by carbonic oxide on the blood of an animal which is caused to breathe for one hour air suspected of containing carbonic oxide. The method was devised for the estimation of after damp in mines; and is described in a paper in the "Comptes Rendus" for Nov. 8, 1897. It is applicable to air containing 1-500th to 1-60,000th

of its volume of carbonic oxide. If air contains more than 1-100th of its volume of carbonic oxide, the animal dies in less than an hour.

A very sensitive method, devised by Nicloux, for the detection of small quantities of carbonic oxide in air, was also employed in order to avoid the wanton destruction of animals. It depends on the oxidation of carbonic oxide by anhydrous iodic acid. This reaction was first of all observed by Ditte; and was used by both Harpe and Reverdin for detecting carbonic oxide in air. Nicloux's method is as follows: The gas or air under examination is drawn, by means of an aspirator, through a train of apparatus, consisting of the following pieces in the order in which they are named. Three **U**-tubes, the first containing pellets of caustic potash for the absorption of carbonic acid, the second sulphuric pumice as a desiccating agent, and the third 30 to 40 grammes of anhydrous iodic acid; a Wills' potash bulb containing 5 c.c. of solution of caustic potash, specific gravity 1.2, diluted with 5 c.c. of water, which solution fixes the iodine which is liberated from the iodic acid by carbonic oxide. The **U**-tube containing the iodic acid is immersed in an oil bath heated to 150° C. As soon as the necessary volume of gas has traversed the apparatus, the solution of potash is washed into a 100 c.c. measure, and its volume made up to 40 c.c.; then there are added to it some sulphuric acid, 5 c.c. of carbon bisulphide, and a few centigrammes of sodium nitrite. The whole is then agitated. The carbon bisulphide dissolves the iodine liberated from the iodic acid by the carbonic oxide, and acquires a red tint. A comparative test is made by adding from a burette a solution containing 0.0001 gramme of potassium iodide per c.c. to another measureful, until an equally deep tint is attained. The volume of carbonic oxide, expressed in cubic centimeters at 0° C. and 760 mm., is found by dividing by 3 the number of milligrammes of potassium iodide used. This method is very convenient. But as acetylene, ethylene and petroleum vapors also reduce iodic acid, the quantitative results should, as a rule, be checked by the physiological method.

Using these methods of estimation, the products of combustion of various types of gas burners were examined.

The Flatflame (Butterfly or Batswing) Burner.—Three of these burners were placed at equal distances apart on a ring, through which gas, measured by a meter, was supplied to them. Around the burners was placed a cylinder of galvanized iron, 26 inches high and 16½ inches wide, provided with a hinged door 8½ inches wide and 4¾ inches high. To the top of the cylinder was soldered a pipe 20 inches high, which communicated, by means of a copper pipe bent at right angles, with a gasholder in which was a dog weighing 13¼ lbs., the blood of which had been examined and found to be normal. The dog was allowed to breathe the products of combustion, and the air which was carried along with them into the gasholder, for one hour. Its blood was then again examined, and gave a rather greater reduction, indicating that the mixture which the dog breathed contained 1-60,000 part of carbonic oxide. This trial proved that the three flat-flame burners, which together consumed 15.68 cubic feet in the hour, yielded only a very trifling and negligible quantity of carbonic oxide.

Staircase Lighting and Ventilation.—The temperature at the upper floors of staircases lighted by gas is high; and the air is vitiated. In one case, three hours after the gas was lighted, the air at the fifth (top) floor contained $\frac{19.5}{10,000}$ of carbonic acid, which is about six times the amount in pure air, and 20.5 per cent. of oxygen in place of 20.8. The air on staircases, therefore, appears not to be renewed sufficiently often. A remedy would be found by providing holes in the ceiling at the top of the staircase, or a pipe, for the exit of the hot air; but care should be taken that the draught so created should not be excessive.

Argand Burner.—An Argand burner consuming 5.4 cubic feet per hour was lighted. It produced 3.38 cubic feet of carbonic acid per hour. About an inch above the level of the top of the chimney was placed a sheet iron cylinder 2 inches high and 4¾ inches wide. This terminated above in a pipe, 34½ inches high, from which a sample of the mixture of the products of combustion and the air drawn in by them was aspirated through baryta water. Of this mixture 1,350 c.c. produced a precipitate which yielded on decomposition 4 9 c.c. of carbonic acid, or the mixture contained 0.36 volume per cent. of carbonic acid. The mixture was found to contain 20.07 per cent. of oxygen; and therefore 0.73 per cent., or double the amount of carbonic acid found, had been used up in the combustion of the gas.

A simple calculation gave the amount of air drawn up the tube by the burner. It was 28,900 liters per hour, showing that about 1,000 cubic feet of air were drawn into the pipe placed over the lighted Argand burner.

Heating Burners.—A similar experiment to that made with the Argand burner was carried out with an atmospheric burner, consuming 21½ cubic feet per hour, and forming 13.4 cubic feet of carbonic acid per hour. Such burners are commonly used in laboratories and kitchens. Around this burner was placed a cylinder of galvanized iron, 26½ inches high and 16½ inches wide, terminating above in a pipe 20 inches high and 2½ inches wide. Five minutes after the burner was lighted the temperature of the air in the pipe was found to be 446° F.; 10 minutes afterwards it was 509° F. The mixture of air and products of combustion which passed up the pipe was found to contain 2.24 per cent. of carbonic acid, and only 18 per cent. of oxygen (in place of 20.8 per cent. in pure air). The volume of air which passed through the pipe in an hour was calculated and found to be 600 cubic feet. On applying a lighted taper to the door of the cylinder, it was found that the draught was sluggish, and that a portion of the products of combustion passed out at the lower part of the cylinder. A pipe, having a total height of 88 inches, was then used in place of the shorter pipe, and a good draught was thus secured. The temperature at the top of the pipe was then found finally to be 400° F. The mixture aspirated from the pipe contained 1.458 volumes per cent. of carbonic acid; and calculation proved therefrom that 940 cubic feet of air were drawn up the pipe in one hour. These figures showed that makers of heating appliances should be careful to place them in positions where the draught is sufficiently great to secure the elimination of the products of combustion and the air drawn up with them. They should avail themselves of the heat of the products in order to secure proper ventilation of an apartment.

The Production of Carbonic Oxide by the Combustion of Gas.—When the flame of a Bunsen burner is allowed to strike back, and the gas to burn at the base of the burner, acetylene and carbonic oxide are found in the products of combustion. On placing a funnel above the burner and compelling an animal to breathe the products and air collected therefrom, it died from oxycarbonated blood. In order to ascertain that its death did not result from the escape unconsumed of carbonic oxide present in the coal gas, the latter was passed through a solution of cuprous chloride in hydrochloric acid, which solution absorbed the greater part of the carbonic oxide in the gas. On burning the gas thus treated in a Bunsen of which the flame was allowed to strike back, the effect on an animal was precisely the same as when untreated coal gas was thus burnt. A sample of methane or marsh gas was prepared by heating acetate of soda with twice its weight of soda lime. This methane, when burnt in the same manner in a Bunsen, yielded products which smelt strongly of acetylene. The blood of an animal which breathed the mixture of these products and the air drawn up by them for half an hour was shown to contain gas with 16.6 per cent. of carbonic oxide. Therefore, even marsh gas, when incompletely burnt, was proved to yield carbonic oxide; and a laboratory illustration of the phenomenon of the production of afterdamp by explosions in mines was thus furnished. In mines, however, the dust which permeates the air, in the event of an explosion, increases the production of carbonic oxide, as Professor Chesneau and Dr. Haldane have proved. The author's researches indicate that whenever flame is obstructed, whether by the bottom of a vessel, the sides of an enveloping tube, or, as in the case of mine explosions, by the uneven walls of coal, carbonic oxide is formed.

The Welsbach Burner.—The author repeated with care experiments he had formerly made, which went to prove that carbonic oxide was present in the products of combustion from the Welsbach burner, and he confirmed his earlier results. In a sample of gas collected from a point about an inch above the mantle, carbonic oxide was proved to be present by the physiological test. Of many researches, the following one may be instanced as typical: In a room about 12 feet square and 12 feet high, three burners were lighted at nine in the morning, and at four in the afternoon the air of the room was examined for carbonic oxide and found to contain $\frac{1}{3000}$ of its volume of that gas. This quantity was far too small to be in any way dangerous to health; but the fact that carbonic oxide was present at all indicates that special attention should be paid to the adequate ventilation of rooms lighted by incandescent burners. It seems possible that the carbonic oxide results from the dissociation of carbonic acid at the high temperature of the mantle.

In order to carry off the products of combustion from heating burners in laboratories and kitchens, the author has devised a cupboard with a sliding glass front, resembling the draught cupboard of a laboratory, in which to inclose the burners during use. The noxious products may thus be conveyed directly from the burners to the exterior of the room. The author recommends also that gas should be turned off at the meter when a household retires for the night, as the escape of carbonic oxide from leaky fittings, etc., into the sleeping apartments would thus be prevented.

Pipe Flanges and Their Bolts.

[A paper read by MR. A. F. NAGLE at the Washington Meeting Am. Soc. Mech. Engineers.]

There is probably no part of a steam plant which presents so untidy, so incongruous, an appearance as the exposed pipe flange joint. The engine itself is handsomely finished, and all its steam joints are steam-tight and covered in a substantial manner with non-conducting material and sheet steel. But we do not get away from this finished and polished machine before we are offended by the sight of rough, uncovered and hot pipe flanges. Why is this unsightly practice continued? Why should not a simple little round pipe joint be made as steam-tight as any other part of the engine?

The practical engineman will tell you that all these steam pipe joints are liable to leak or blow out at any time, hence he wants to have easy and quick access to them, which he would not have if they were covered. Here is a confession of a weak point in our steam engineering practice that should not be allowed to go on forever. I have given this subject considerable study of late years, and some of my conclusions I shall be glad to lay before this Society.

It can scarcely be imagined that it is difficult to make a single flange joint steamtight when undisturbed by an extraneous force. The fact, however, is that in a modern large steam plant the elongations due to heat are irresistible, and provision must be made to take care of them. This is not always easy to do within the limited space at command, but it may be set down as a guiding principle that wherever possible it is better to let these expanding forces come upon torsional resistance rather than in the form of transverse stress upon the pipe and its flanges. Flexure produces a strain upon the bolted joint which it is not able to stand to any appreciable degree without opening up the joint, but torsion is easily resisted by a bolted joint to any degree even to the point of twisting the pipe to destruction, should it not possess sufficient flexibility to give the required amount of angular motion.

Let us now analyze the forces at work upon a flange joint, its bolts and gasket, for the standard high pressure flanges (250 pounds per square inch).

The first problem that presents itself is the available power of bolts to make tight joints. In our *Transactions*, Vol. XII., p. 781, Mr. McBride favors us with a practical test of the lifting power of a common rough screw bolt. These experiments, together with the discussion which followed his paper, clearly indicate that only 10 per cent. of the theoretical power of a bolt may be taken as its effective or actual binding power.

These experiments also show that 200 pounds may be taken as the maximum pull one man can exert for a moment in tightening up a nut.

With these data before us I have constructed Table I., which gives the available power of different size bolts with various lengths of wrenches, and also what length of wrench would be required to obtain the safe limit of stress of metal in a bolt—say 10,000 pounds per square inch.

It will be seen by column 6 that about 10,000 pounds effective binding force is available with one man and the ordinary length of wrenches in use.

Mr. McBride gives it about 7,500 pounds, but I have assumed longer wrenches than were used by him.

It will be seen that a ¾-inch bolt should be strained to only 3,020 pounds when its fiber stress amounts to 10,000 pounds per square inch. This is fully as much as it is safe to put on it, for a noncalculable allowance must be made for the weakening effect of the sharp thread ending in a rough and eccentric manner to the body of the bolt, and its head and nut not having a full and fair bearing. These causes make the bolt much weaker than its calculated strength, and 7,000 pounds per square inch would probably be as great a stress as it is safe to put upon the bolt metal.

Column 9 shows what length of wrench would be required, allowing 1½ inches from end to center of hand, and exerting a pull of 200 pounds, in order to strain the fiber in bolt to 10,000 pounds per square inch. Two hundred pounds is probably more than men will pull on a wrench, still they can do it by bracing their feet.

Having established a pressure obtainable by bolts let us now turn to Table 2 and see what the result is when applied to flange joints. Columns 1, 2, 3 and 4 are self-explanatory, except to add that these dimensions are those given by the Chapman Valve Company, and all calculations following are based upon 250 pounds pressure per square inch.

Column 5 gives the pressure per square inch upon the gasket and is found by subtracting from the power of the bolts, found in Table I., column 8, the steam pressure on the area of the pipe, and dividing the result by the net bearing area of the full flange.

For example: A 6-inch pipe flange has 10 ¾-inch bolts whose combined pressure = 42,000 pounds.

Pressure in 6-inch pipe at 250 pounds per square inch = 7,075 pounds. Net total pressure on gasket = 42,000 — 7,075 = 34,925 pounds. Net area of flange = 105 square inches. Pressure on gasket per square inch = 34,925 ÷ 105 = 336 pounds.

It will be observed that the pressure upon the gasket is small, going as low as 168 pounds per square inch on a 16-inch pipe, and the highest is 347 pounds per square inch on a 3½-inch pipe. With 250 pounds steam pressure these pressures upon the gasket are small, and it is not surprising that when a slight transverse stress is produced by expanding pipes the joint is opened on one side and leaks begin. We naturally turn to the need of a tongue and groove to reduce the bearing area of the gasket.

The groove also has the merit of protecting the gasket from misplacement, or being forced out in part by the pressure of the bolts; the gasket is also protected from being blown out if slightly relieved on one side. The disadvantage is that the gasket is not renewable without opening up the space between the pipes several inches, which is not always possible. But I am pleading for a system of piping and joints which will not blow out or need renewal.

If we turn to column 6 we shall find the width of tongue used by the Chapman and Crane Companies. One half inch is too narrow for practical safe handling of gaskets. Column 7, however, shows the effective pressure on these narrow gaskets. In the smaller sizes the pressure runs up to 2,500 pounds per square inch, and in the larger sizes it goes as low as 600 pounds per square inch.

It would appear at once that some more nearly uniform pressure upon the gaskets would be desirable, and I have therefore assumed that 1 inch width for all sizes of pipes would be a very good standard to use. Still retaining the Chapman bolt table, columns 8, 9 and 10 will show the result of using this width of tongue. It will now be seen that the pressure per square inch of gasket varies but little from 1,000 pounds, although a few extreme cases go from 755 pounds to 1,360 pounds.

We could use said bolt table, but change the width of tongues to 1 inch, and yet get very much better practical results than with existing proportions, but to get still better and more uniform results as indicated in column 17, I have revised the number and sizes of bolts slightly. Columns 11 and 12 give the Chapman bolt table, columns 13 and 14 the Crane, and 15 and 16 the one I recommend. It will be observed that I have not created any new sizes, but have used in part from each of the above mentioned tables.

The Crane table evidently has aimed to make the number of bolts divisible by 4, so as to permit turning valves quartering after being drilled; whether this is of sufficient practical importance to offset the better holding of joints I am not prepared to say, but we see now what is desirable for bolts and gaskets, and we can come as near to its fulfillment as circumstances will admit of.

Up to and including 9-inch pipe I have not changed the Chapman bolts, but for 10-inch and 12-inch I have adopted the Crane table, namely, 12 and 16 bolts 1 inch in diameter respectively, instead of 15 and 18 seven-eighth bolts, not simply because they give somewhat greater pressure on the gasket, but for reasons already pointed out, namely, that the ⅞ inch bolt is below the safe minimum size bolt pointed out in Table I. I will also add that my personal practice has banished the ⅞-inch bolt from use on these sizes of pipes years ago, because I have found it would not stand the strain put upon it in practical use.

On the 16 inch pipe the Crane 20–1-inch bolts give better results than the Chapman 18–1-inch, and I would recommend this number and size. On the 15 inch pipe, a rather odd size, I would also make 20–1-inch bolts instead of 18–1-inch. In all sizes above 16 inch these two manufacturers agree, but I recommend that the 22-inch pipe flange bolts be increased from 1⅛ to 1¼-inch, the number (24) remaining the same.

It is striking how much more uniform pressures upon the gaskets are produced by a standard width of tongue of 1 inch than by the present practice, and it seems to me that the adoption of such a standard would be very desirable.

In column 9 are given the inside diameters of tongues if my recommendations were adopted.

The tongues and grooves of the Crane Company are of precisely the same diameters as those of the Chapman Company.

The projection of tongues in Chapman tables varies from $\frac{3}{16}$ inch to $\frac{7}{16}$ inch; the depth of the grooves is not given. In the Crane tables the projections of tongues vary only from $\frac{3}{16}$ inch to ¼ inch. and the depth of grooves is always $\frac{1}{16}$ inch less than the tongues.

I would recommend for adoption in all cases a uniform tongue projection of $\frac{1}{4}$ inch and depth of groove of $\frac{3}{16}$ inch.

One word about the thickness of flanges. When the tongue and groove construction is used the flange becomes an overhanging beam and it should be made very strong. I would recommend that in all cases the flange be thickened at the bolt with a hub extending back as far as the hub of the flange. This is a construction already in use by some manufacturers in some of their flanges.

In order to carry out more completely the writer's idea of relieving flange joints of all transverse stress, or flexure, and substituting, so far as possible, torsional strains therefor, I have designed a pipe construction which admits of torsional movement to a large degree without straining either the material of the tube or the flange joint to any appreciable extent. It is shown in Fig. 1 and consists of what might be

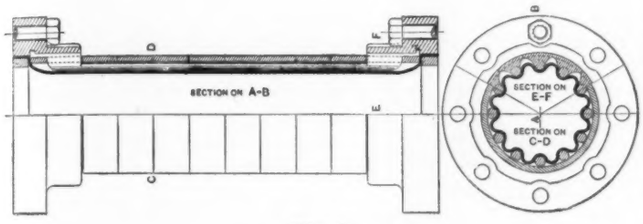


Fig. 1.

termed stave construction instead of solid pipe. These staves are steel rods securely fastened to the flanges. Exterior to these staves are strong iron or steel enveloping rings. Interiorly is a thin, longitudinally corrugated copper tube also securely fastened to the end flanges.

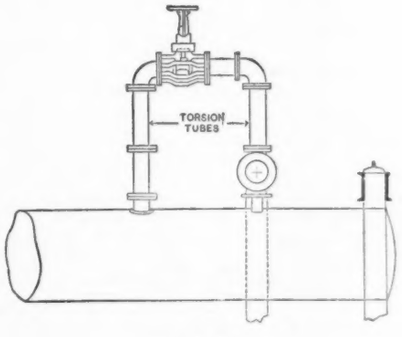


Fig. 2.

We now have a pipe which is strong in every direction but one, namely, that to resist torsion. With these flexible tubes put in in the proper manner, all elongations of steam pipes should be easily taken care of and without straining any joint to a dangerous degree. See Fig. 2.

I do not intend to patent this form of pipe, and hence it can be made by any one who chooses to do so.

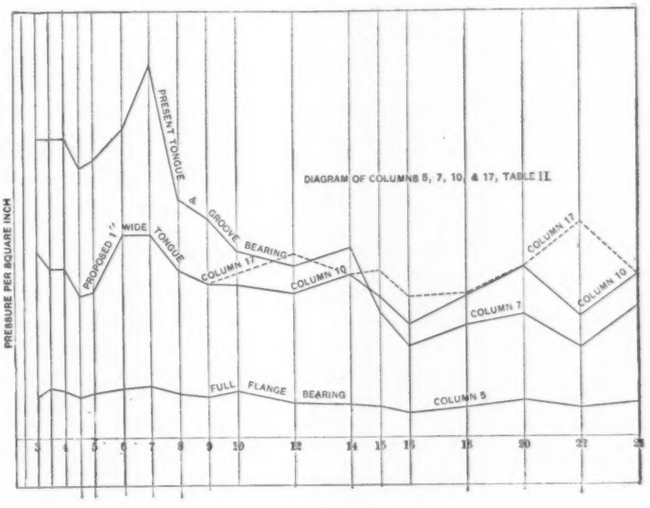


Fig. 3.

TABLE I.

Diameter of Bolt.	T= Threads per Inch.	Length of Wrench	C= Effective Circumferences.	P= Theoretical Pull of Screw.	Effective Pull.	Area of Bottom of Thread.	Pull of Bolt at 10,000 Lbs. Stress of Metal per Sq. In.	Length of Wrench.
Inches		Inches.	Inches.	Pounds.	Pounds.	Inches.	Pounds.	Inches.
$\frac{3}{4}$	10	10	53	106,000	10,600	.302	3,020	4
$\frac{7}{8}$	9	10	53	95,400	9,540	.420	4,200	$5\frac{1}{2}$
1	8	12	66	105,600	10,560	.550	5,500	7
$1\frac{1}{8}$	7	12	66	92,400	9,240	.694	6,940	$9\frac{1}{2}$
$1\frac{1}{4}$	7	12	66	92,400	9,240	.893	8,930	12
$1\frac{1}{8}$	6	16	91	109,200	10,920	1.06	10,600	16
$1\frac{1}{2}$	6	16	91	109,200	10,920	1.30	13,000	18
$1\frac{5}{8}$	$5\frac{1}{2}$	16	91	100,100	10,010	1.52	15,200	24
$1\frac{3}{4}$	5	18	103	103,000	10,300	1.75	17,500	30
$1\frac{7}{8}$	5	18	103	103,000	10,300	2.05	20,500	36
2	$4\frac{1}{2}$	18	103	92,700	9,270	2.30	23,000	42
1	2	3	4	5	6	7	8	9

3. Length of wrench customarily used in shop practice.
4. Application of hand taken at 1½ inches from end of wrench.
5. Pull or force of man taken at 200 pounds, or $P = C \times T \times 200$.
6. Effective Pull = 10 per cent. of last column.
8. When metal is strained to 10,000 pounds per square inch, bolt is strained, or will resist, as per this column.
9. (Length of wrench − 1½) × 3.1416 × T × $\frac{200}{10}$ = column 8.

TABLE II.

Diameter of Pipe.	Diameter of Flange.	Bolts. Number.	Bolts. Diameter.	Net Pressure on Gasket per 1 Sq. In.	Width of Tongue.	Net Pressure on Gasket per 1 Square Inch of Tongue.	Width of Tongue.	Inside Diameter of Tongue	Net Pressure on Gasket per 1 Square In. of 1 inch Tongue.	Chapman B'lts Number.	Chapman B'lts Diameter.	Crane Bolts. Number.	Crane Bolts. Diameter.	Nagle Recommends. Number.	Nagle Recommends. Diameter.	Net Pressure per sq. in. on Gasket 1 Inch Tongue, Nagle B'lts.
Inches.	Inches.		Inches.	Pounds.	Inch.	Pounds.	Inch.	Inches.	Pounds.		Inches.		Inches.		Inches.	Pounds.
3	9	6	$\frac{5}{8}$	250	$\frac{1}{2}$	2,000	1	$3\frac{3}{8}$	1,254	6	$\frac{3}{4}$	8	$\frac{5}{8}$	6	$\frac{3}{4}$	1,254
$3\frac{1}{2}$	9	7	$\frac{5}{8}$	347	$\frac{1}{2}$	2,000	1	4	1,150	7	$\frac{3}{4}$	8	$\frac{5}{8}$	7	$\frac{3}{4}$	1,150
4	10	8	$\frac{5}{8}$	320	$\frac{1}{2}$	2,000	1	$4\frac{3}{8}$	1,130	8	$\frac{3}{4}$	8	$\frac{5}{8}$	8	$\frac{3}{4}$	1,130
$4\frac{1}{2}$	$10\frac{1}{2}$	8	$\frac{3}{4}$	288	$\frac{1}{2}$	1,800	1	$5\frac{1}{4}$	950	8	$\frac{3}{4}$	8	$\frac{3}{4}$	8	$\frac{3}{4}$	950
5	11	9	$\frac{3}{4}$	300	$\frac{1}{2}$	1,857	1	$5\frac{3}{4}$	975	9	$\frac{3}{4}$	8	$\frac{3}{4}$	9	$\frac{3}{4}$	975
6	13	10	$\frac{3}{4}$	336	$\frac{1}{2}$	2,057	1	$6\frac{1}{2}$	1,360	10	$\frac{3}{4}$	8	$\frac{7}{8}$	10	$\frac{3}{4}$	1,360
7	14	12	$\frac{3}{4}$	350	$\frac{1}{2}$	2,500	1	$7\frac{1}{2}$	1,360	12	$\frac{3}{4}$	12	$\frac{7}{8}$	12	$\frac{3}{4}$	1,360
8	15	12	$\frac{7}{8}$	300	$\frac{5}{8}$	1,600	1	$8\frac{1}{2}$	1,130	12	$\frac{7}{8}$	12	$\frac{7}{8}$	12	$\frac{7}{8}$	1,130
9	16	13	$\frac{7}{8}$	283	$\frac{5}{8}$	1,474	1	$9\frac{1}{2}$	1,030	13	$\frac{7}{8}$	12	$\frac{7}{8}$	13	$\frac{7}{8}$	1,030
10	$17\frac{1}{2}$	15	$\frac{7}{8}$	267	$\frac{3}{4}$	1,250	1	11	1,030	15	$\frac{7}{8}$	12	1	12	1	1,110
12	20	18	$\frac{7}{8}$	236	$\frac{3}{4}$	1,160	1	13	963	18	$\frac{7}{8}$	16	1	16	1	1,240
14	23	18	1	231	$\frac{3}{4}$	1,270	1	15	1,095	18	1	16	1	18	1	1,100
15	$23\frac{1}{2}$	18	1	213	$\frac{7}{8}$	830	1	16	925	18	1			20	1	1,130
16	25	18	1	168	$\frac{7}{8}$	618	1	17	755	18	1	20	1	20	1	950
18	$27\frac{1}{2}$	24	1	200	1	754	1	19	972	24	1	24	1	24	1	975
20	29	24	$1\frac{1}{8}$	257	1	930	1	21	1,160	24	$1\frac{1}{8}$	24	$1\frac{1}{8}$	24	$1\frac{1}{8}$	1,160
22	31	24	$1\frac{1}{8}$	191	1	600	1	23	827	24	$1\frac{1}{8}$	24	$1\frac{1}{8}$	24	$1\frac{1}{8}$	1,450
24	34	24	$1\frac{1}{8}$	222	1	888	1	25	1,100	24	$1\frac{1}{8}$	24	$1\frac{1}{8}$	24	$1\frac{1}{8}$	1,100
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17

Test of a Steam Separator.

[A paper prepared by MR. F. L. EMORY for the Washington Meeting of the Am. Soc. of Mech. Engineers.]

The test recorded below is that of a baffle-plate pattern separator designed to serve as a live steam separator, as an exhaust steam separator or trap, and as an oil extractor.

The method of testing the separator consisted, in brief, of a determination of the character or quality of the steam before entering the separator, and also its quality after leaving it. Various pressures of steam and different velocities and amounts of steam running through the separator were noted, as also the quality of the entering steam was changed for various runs, as will appear from the readings and quality results of the wet steam calorimeter.

Apparatus used :

In the first eleven runs noted in the tabulation the following method was pursued : Steam coming from the boiler through a valve *A*, Fig. 1, passed downward through piping *B*, which was surrounded by a water jacket, then after two short right bends traveled vertically, giving up in its vertical portion a sample to a separating calorimeter *CD;* with one right bend again, steam after a short connection entered the horizontal separator *G*. Passing out of the separator the discharged steam gave up a sample to another separating calorimeter *M* on its way to the condenser, a surface condenser through which the steam passed, as water into a barrel to be weighed. In the last five runs, Nos. 14 to 18, the condenser was not used, but the flow of steam was measured by Napier's law ; the steam flying at higher pressures than before and at higher velocities through a measured nozzle.

In the runs after No. 11 the throttling calorimeter was used in addition, but did not prove satisfactory, the steam being quite too wet for accurate determination.

Description of Apparatus.—A is the valve connecting steam main with boiler, through which steam passes along the pipe and thus upwards. At *B* is a cold water jacket by means of which the steam to be used in the separator test was changed in quality. At *C* a steam nozzle

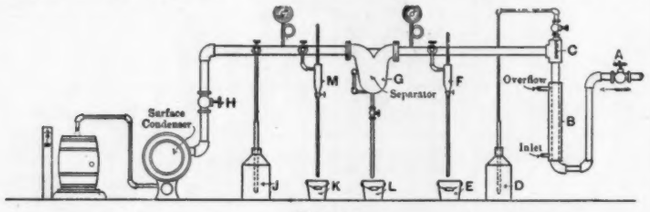


Fig. 1.

took steam sample from the vertical pipe to a separating calorimeter *D*, and the steam's quality was thus known before passing into the separator. The steam gauge and throttling calorimeter *F* also checked this determination. The steam then passed through the separator *G*, and the drips were collected at *L*, the water level in the separator being kept constant. After passing the separator the steam was again sampled by the throttling calorimeter *M* and the separating calorimeter *J*, and passed through the valve *H*, by means of which the velocity was controlled and changed on different runs. The steam condensed by the surface condenser was pumped to the barrel on the platform scales and weighed. The throttling calorimeter on the right was not used with the very wet steam. By using the valves of the drips *L* and *K*, and also the steam used by the calorimeter *J*, the separator itself was used as a check calorimeter. All apparatus was carefully calibrated before the runs.

Log of Test.

Run.	Time, Minutes.	Pressure in Dry-steam Gauge above Atmosphere.	Pressure in Wet-steam Gauge above Atmosphere.	Water from Separator, Lbs.	Condenser Steam, Lbs. Net.	Wet-steam Calorimeter.		Dry-steam Calorimeter.	
						Water in Scale, Lbs.	Water in Can, Lbs.	Water in Scale, Lbs.	Water in Can, Lbs.
1	12½	20¾	19.4	22.8	302.95	.023	2.5	Not	taken
2	Not tak'n	34.8	34.3	37.75	307.5	.023	1.9	.045	1.51
3	11½	21.2	20	25	231.87	.16	2.05	.075	1.8
4	7	29.5	27.5	9	335.5	.07	1.4	.058	1.6
5	8	35.5	34	15.5	317.25	.1	1.6	.115	2.15
6	7	11.4	10.6	10	319.5	.08	1.15	.11	1.1
7	8½	16.5	15.8	12	367.25	.08	1.75	.06	1.45
8	6	29.8	29	10	343	.14	1.7	.115	1.65
9	8	86.1	86.6	26	322.75	.215	1.3	.059	1.7
10	9	83.1	83.6	33	365.5	.21	1.15	.09	2.45
11	12	1.3	1	12	355	.04	1.05	.057	.30

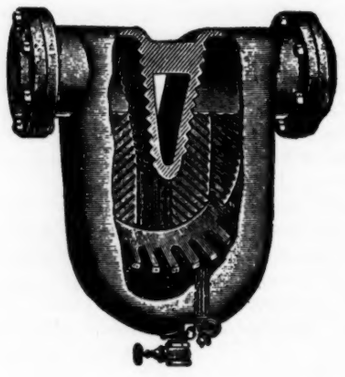


Fig. 2.

Log of Test (Continued).

Run.	Time, Mins.	Pressure in Separator in Lbs. Gauge.	Separating Calorimeter.		Throttling Calorimeter Temp.	Water from Separ-ator, Lbs.	Condensed Steam Used, Lbs.
			Water in Can, Lb.	Water in Scale, Lb.			
12	19	3	.8	.02	212°	9	309
13	9	3.25	.35	.01	216°	16	154

Radiation at 3 pounds = 2.2 pounds for 8 minutes, = .27 pound per minute.
Oil separation : Oil put in 1.42 pounds, taken out .48 pound, per cent. regained = 22 per cent.

Log of Test with Nozzle.

Run.	Time, Mins.	Pressure, Lbs. Gauge.	Separating Calorimeter.		Water from Separator, Lbs.
			Water in Can, Lbs.	Water in Scale, Lbs.	
14	9½	60	Not taken	—	3.25
15	9½	47.5	.65	.04	4.9
16	9½	52	.65	.055	4.72
17	9	52.3	—	—	4.65
18	9½	70.2	.9	.035	4.95

Radiation = 1.07 pounds in 10 minutes. = .107 pound per minute.
Pressure after leaving or at nozzle averages 1.5 pounds gauge.

Quality of Steam.

	Before Entering Separator.	After Passing Separator.
Run No. 1.....	....	....
" 2.....	89.2 per cent.	97.1 per cent.
" 3.....	93.2 "	96.1 "
" 4.....	95.2 "	96.5 "
" 5.....	94.1 "	96 "
" 6.....	93.5 "	91 "
" 7.....	95.7 "	96 "
" 8.....	92.4 "	93.2 "
" 9.....	85.4 "	96.6 "
" 10.....	85 "	96.4 "
" 11.....	96.3 "	97 "
" 12.....	97.5 "	99.7 "
" 13.....	95 "	.... "
" 14.....	.... "	.... "
" 15.....	94.2 "	95.3 "
" 16.....	92.2 "	93.3 "
" 17.....	96.2 "	97.3 "
" 18.....	.... "	.... "

By using the separator itself as a calorimeter we may find the per cent. of moisture removed by separator. We have by the wet steam calorimeter the quality of the steam at entering, which, added to the moisture removed by separator, will be the quality after passing the latter. For this experiment, as stated, the nozzle was used, and, if W = the amount in pounds per second flow, F = the area orifice in square inches, and p_1 = the initial pressure absolute, then where $p_1 > \frac{5}{3}$ atmosphere, or p_2.

$$W = \frac{Fp_1}{70}$$

Here $F = .7854$.

Computing the same for various pressures and runs we have :

	Value of W in Pounds Total.	Removed.
Run No. 14.....	528	.6 per cent.
" 15.....	408	1.1 "
" 16.....	416	1.1 "
" 17.....	406	1.1 "
" 18.....	530	.9 "

These per cents. added to the quality before entering give the values shown for runs 14 to 18.

From the general run of the results as shown on the table of qualities it would seem that runs 6 and 12 should be thrown out as being in all probability associated with some error of conditions or observations If we do so we would conclude that this separation in good condition and for the higher velocities of steam flow will deliver steam of say 97 per cent. dryness, and has little separating qualities in steam of drier quality. And we are quite safe in concluding that it will, if kept well drained, deliver a steam dry within 3 per cent. There seems to be little difference in its action for live steam from boiler and the exhaust steam or steam of low pressure of considerable wetness. The steam of 3 pounds above atmosphere, corresponding to ordinary engine exhaust, was, as will be seen from its quality in the table, made to contain by means of the jacket considerable moisture, and again made quite dry. The action, however, was similar to that for steam of higher pressure and similar wetness, namely, to deliver steam of say 97 per cent., irrespective of original quality.

Test of a Baffle Plate Steam Separator as an Oil Separator.—Test of the above separator as an exhaust steam separator and oil separator.

The apparatus before mentioned was used in the test as an oil separator ; the calorimeters and their leading pipes, and all unnecessary attachments were removed, and a force pump, small pump oiler, was attached at the bottom of the first vertical pipe leading to the separator as described before. A steam gauge was attached at a point beyond the separator, which recorded the pressure in the separator, and the steam was allowed to flow through and into the air, discharging as in ordinary practice in a non-condensing engine.

The method pursued was, in brief, to pump a known amount of cylinder oil into the pipe leading to the separator, and to draw away from the separator through the drip at the bottom the oil and water separated from the steam on its passage. The per cent. of efficiency of the arrangement would evidently be the ratio of the amount taken out to the amount put in, multiplied by 100.

This was done ; a goodly supply of "vacuum" cylinder oil was pumped into the pipe slowly as it would be in working conditions in the engine manipulations, and the oil coming away with the water was carefully skimmed off and weighed. Much care was exercised in the beginning to see that a quantity of oil sufficient to oil all the parts between the pump and separator was put in so that all interstices and joints might absorb or take up all that they might hold and so to insure that no oil would be caught and held before entering the separator and after leaving the pump. In fact a run was made at first, which is not here recorded, which served as a zero point to begin observations.

It was found that it was impossible to skim the mixture of oil and water so carefully as to warrant saying that the skim was only oil, although to the eye there were no water globules present, but the specific gravity of the oil regained was much heavier than that put in, and the weight of mixture taken out was much greater than of oil put in. The mixture was cooled to 60° F., and from its weight and specific gravity was figured the probable weight of oil in the mixture. The water which existed in the oil or mixture is held in very small globules between the parts of the heavier oil, and therefore affects the specific gravity and weight directly in the proportion of its existence. This mixture being homogeneous, we have the following method of calculating the oil present :

Let x = weight of water in mixture.
Let y = weight of oil in mixture.
Let V_1 = volume of water in mixture.
Let V_2 = volume of oil in mixture.
Let $V_1 + V_2$ = volume of oil and water in mixture = V_3.

Then the relative volumes equal the weight divided by the specific gravity, or

$$V_1 = \frac{x}{1},\ V_2 = \frac{4}{.893},\ V_3 = \frac{5.1}{.942};$$

then

$$x + \frac{y}{.893} = \frac{5.1}{.942}\text{ ; but, again,}$$

$x + y = 5.1$, $x = 5.1 - y$,

$$5.1 - y + \frac{y}{.893} = \frac{5.1}{.942},$$

$$y\left(\frac{1}{.839} - 1\right) = \left(\frac{5.1}{.942} - 5.1\right),$$

$$y = \frac{\frac{5.1}{.942} - 5.1}{\left(\frac{1}{.891} - 1\right)} = \frac{.314}{.19418} = 1.6176 \text{ pounds.}$$

But amount put in = 3.05, and since amount taken out is 1.6176 then efficiency $\frac{\text{Oil taken out}}{\text{Oil put in}} = \frac{1.6176}{3.05} = 53$ per cent.

Tests.

	Oil Put In.	Mixture Taken Out.	Specific Gravity Mixture.	Per Cent. Oil Regained.
Run No. 1.....	1.86 pounds.	2.81	.930	58.6
" 2.....	3.05 "	5.1	.942	53
" 3.....	1.4 "	1.82	.940	42
Average.....				51.2

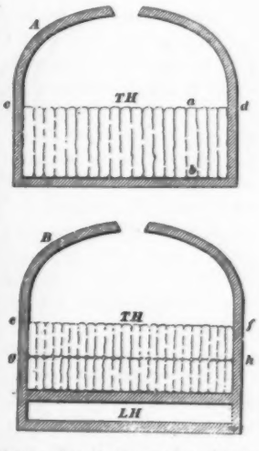
The specific gravity of the oil put into the pipe through pump was .893 at 60° F.

These experiments prove that, in round numbers, 52 per cent. of the oil, as pure oil, was regained, although the mixture which might be used for lubrication again was a much larger amount.

The Manufacture of Short Coke.

In dealing with this subject, *Mines and Minerals* remarks that the term short coke is the antithesis of the term long coke. The latter term is applied to all good coke made in ordinary beehive ovens, and consists of columns or rods of coke that frequently have a mean axial length of 20 inches, and the former term is applied to all good coke made in by-product ovens and consists of rods having a mean axial length of 8 inches. General preference was given, when by-product ovens were first introduced, to long coke, but since short coke has been made of greater hardness and greater compressive strength than the average product of the beehive oven, short coke has secured more favor. There are uses to which coke is applied that require shorter columns than those of the close or by-product ovens, and it is to the manufacture of these this article applies.

With regard to short coke it may with safety be asserted that it is the coke of the future, if the following statements are true : (*a*) Hard, strong, short coke can be made with coal, that will not make even a second class long coke in ordinary beehive ovens. (*b*) With the same class of coal, short coke in closed ovens can be made harder and stronger than long coke. (*c*) With the same class of coal, short coke in closed ovens can be made cheaper than long coke. (*d*) With the same class of coal making short coke in closed ovens a higher percentage of coke can be obtained than when making long coke.



Section Showing Formation of Coke.

The statements just made are supported by the following facts : (*a*) Coal is a bad conductor of heat, and but for the heat retained by the walls of a coke oven the times of coking would vary as the squares of the thicknesses of the charges, and as some coal will not coke unless the heat quickly penetrates to the center of the charge, a coal that can be coked when the charge is thin sometimes cannot be coked when the charge is thick. Dr. Muspratt gives the following example : "Certain Staffordshire coals, when treated under ordinary conditions," that is, coked quickly in a beehive, "yield only a brittle fritted coke ; but when subjected quickly to a stronger heat, yield a hard product." (*b*) The quicker the heat required for coking penetrates and permeates the charge of an oven, the harder and stronger is the coke ; for example, when the coal in the interior of a thick charge is subjected to a temperature of 600° F. or a little more, for a period of one to two hours, such coal produces a soft and worthless cinder, and as the adjacent coal is partially injured in the same way, the product is a soft, inferior coke. (*c*) Short coke can be made

cheaper than long coke, because the times of coking vary proportionally as the square roots of the cubes of the thicknesses of the charges; consequently, the proportional times for coking charges of coals 30 and 15 inches in thickness are $\sqrt{30^3} = 164.31$, and $\sqrt{15^3} = 58.09$, or a double charge requires $\frac{164.31}{58.09} = 2.828$ more time in a closed oven for coking than the single one, and the quality of the thin charge is better. (*d*) The yield of good merchantable coke is greater from thin than from thick charges in close ovens. When the charges are too thick, too much "breeze" is produced, and this reduces the disposable yield.

Short coke making in close, or by-product ovens, is attended with no practical difficulties, while short coke making in beehive ovens is beset with insuperable difficulties. The trouble, however, does not arise in the making of the rods of coke short, but in obtaining a good average yield; for example, the upper surface of a thin charge is larger in proportion to the mass than is the same surface of a thick charge, that is, *c d* in the figure is constant for all charges. The result is, the amount of surface coke burnt in coking, and especially in finishing, is disproportionately large for thin charges. This relationship of the surface to the mass cannot be altered, as short coke in a beehive oven can only be made with a thin charge. It is true that relatively short coke can be made in beehive ovens with an ordinary thick charge, when the oven is heated with bottom flues, *L H*, for then the coke rods are cut by the medial plane *g h*, generated at the junction of the top and bottom heat waves. These short rods of coke are, however, relatively long ones compared with the lengths required for such uses as this article seeks to provide for. Extra short coke might be obtained by sizing the produce of ordinary ovens, but this would reduce the margin of profit on the whole of the coke, by an additional expense for handling. Extra short coke should be made as such to be a remunerative transaction, and there are potent reasons for making it in special ovens, of which the following are examples: (*a*) Good, hard, extra short coke can be made with a class of coal that would not make long coke. (*b*) The consumption of fuel for generating the required heat to make 1 ton of extra short coke is less than that required for making 1 ton of long coke. (*c*) The time required for making 1 ton of extra short coke is much less than that required for making 1 ton of long coke.

Altogether, then, it is evident that coke rods should be made as short as possible consistent with the uses to which they have to be applied. The question here arises, what sort of ovens would be the best for the manufacture of extra short coke. Continuous ovens have been tried for the manufacture of ordinary coke, that is, ovens in which a continuous supply of coal is made to enter their upper end while a continuous discharge of coke takes place from their lower one. In most of these ovens the rise in the temperature of the advancing coal is so slow that it is deprived of its coking properties before the true coking temperature is reached. Such ovens are, therefore, out of place for the manufacture of extra short coke. The ordinary close ovens would have to be greatly reduced in length for extra short coke, or otherwise they would be bad to draw, as extra short rods would turn and jam during the process of being forced out. To make extra short coke, then, in closed ovens of the ordinary by-product type, their lateral and longitudinal dimensions would have to be reduced, laterally to shorten the rods of coke, and longitudinally to permit of the easy discharge of the finished coke from the oven. It is seldom wise to expect the best results from improvised articles of any kind, and, therefore, it is better to find if an oven specially adapted for the manufacture of extra short coke should be an entire departure from the type in common use. In this case there can be no doubt about the fact that ovens of the type of the ordinary by-product ones would answer for making extra short coke, providing that the breadths of the ovens were reduced; but making the coke of the required quality and size is not all that is required, for it is of equally great importance that the charging and discharging of the oven should be done quickly and cheaply. To discharge an oven with a ram, the coke moved should be displaceable with a pressure that will neither injure the coke nor the oven, and if this cannot be done then some method of discharging must be found that will comply with this requirement. It is not the business of the writer to invent ovens, either for ordinary or extra short coke, but to introduce through the medium of the principles that operate in the manufacture of good coke, the conditions that must be complied with to secure manufacturing and commercial success. For the manufacture of extra short coke in beehive ovens to be a commercial success, three things must be done: *First*, the ovens must be worked with top and bottom heat, that is, the floor of the oven must be set over hot air flues. *Second*, the coal charge for an oven must have the mean depth proportional to the size of the coke required. *Third*, to prevent the burning and waste in the oven that occur on the upper surface of the coke, the coal charge must be covered with breeze, or small coke that is otherwise wasted. It is true that the cost of production in so far as the making up and drawing of undercharged beehive ovens is concerned, is greater than for full charged ones; but setting off against this the saving in the time of coking and the enhanced value of the coke, the difference in the cost disappears.

[Concluded from page 687.]

Experiences with the Incandescent Gas Light.[1]

By Mr. Norton H. Humphrys, F.C.S.

When the new pattern Welsbach burner was put upon the market, one of the advantages claimed for it was that the use of a pressure regulator was not necessary; whereas that appliance is almost indispensable with the old pattern "C" burner. To some extent this is correct, and the regulator is not a necessity on every burner. But it cannot be dispensed with altogether. Many of the new pattern burners exhibit a remarkable tendency to "roar," as we are accustomed to say in regard to flat flame burners; and this disposition appears to be accelerated when a glass bulb is used to protect the burner. The cause of this annoyance is simply excess of pressure, and is particularly evident on the leading mains or at the higher levels of the district. Commencing with the slight hiss similar to that emitted by some gas fires, a little increase of pressure leads to a decided "hum," and a further increment produces a hooting that may be loud enough to cause great annoyance. In some few cases, a gas lamp has been found to be extinguished in the morning, and a neighboring resident owns to having turned it off to stop the noise. The burner may be perfectly silent during the evening, while the full draught is on the main, but commences singing as the consumption falls off toward midnight. Various sized nipples are supplied by the Welsbach Company to suit different pressures; but this does not meet the case of lamps that, by reason of their location, are subject to wide variations of pressure. At Salisbury, about 5 per cent. of the total number fitted on the street lamps gave trouble on this score; but in all cases the attachment of a pressure regulator has proved to be a cure. As regards inside burners, there has been no advance beyond the hissing stage, and in either case the trouble is more marked with No. 4 burners than with the smaller sizes.

Another matter that gave some trouble for a few weeks, until the cause became clear, was that certain lamps were found to be extinguished by shutting off the tap during the night. There were dark hints of foul play, and someone remembered having seen a man who had recently been discharged from the gas works in the vicinity of one of the lamps in question. Then two lamps adjoining each other in a main thoroughfare were seen burning as usual at 7:15 P.M., and found with the taps turned off at 7:45 P.M. This only happened on stormy nights, and with lamps in exposed positions. A chopping wind, an unnecessarily long chain, and a loose tap were found to be the conditions necessary for this curious result to obtain. The wind set the chain swinging with sufficient momentum to gradually close the tap. Sometimes the tap was only partly shut off, and the lamp being reported as out of order, was found to have turned itself on again, and have nothing the matter with it when the inspector went round. Cases were also recorded where the lamps repeatedly went off and on again. As with other troubles, the remedy was simple. If the chain was shortened so that the ring was pulled close up to the lantern when the tap was open all trouble ceased.

The adjustment of the flash lights is a matter calling for care in order to secure the golden mean between a flame that will go out on the slightest provocation, or for no apparent reason, and one that tails up the side of the mantle and attracts attention in the daytime. We tried some of the arrangements adapted for use with an ordinary torch, such as climbing flash lights, but without success. In windy weather, especially, the jets on the "climber" were blown out. An illustration in the columns of a French gas magazine shows a climbing light protected by a metal case; but I have not seen this advertised in England. The results of experimental tests in this direction were so disheartening that we did not care to try the special lanterns that are used successfully, I am told, at Liverpool; and time did not admit of further delay, so the order for bye pass burners was placed. Some few experiments have been made with self-lighting burners for inside lighting, and these have so far given such satisfactory results that I am thinking of trying a dozen in the street lamps.

1. *Journal of Gas Lighting.*

In old lamps, the tap previously in use has been left, partly because it acts as a reducing piece, but chiefly because it can be used for adjusting the supply according to the level and situation—care being taken to leave a supply sufficient for the minimum pressure, which frequently obtains about the busiest period of the evening. The tap is also convenient to stop the gas while cleaning the burner, adjusting bye-pass tap, etc.; and has therefore been retained in the case of new lamps. The new taps are of the pattern provided with a side plug of full bore, to be used for dealing with stoppages due to naphthaline or frost. Naphthaline is a very rare visitor with us, and frost has also been scarce since the commencement of the new system. But the gasholder tanks have not required steaming or similar attention throughout the winter, so the burners have not yet been exposed to a prolonged frost.

Some difficulty arises in the first start, or with inexperienced men, about the breakage of mantles while in the act of cleaning the lamps. In regard to this matter the shape of the lantern is of some importance. one that is 16 inches square at the eaves gives the operator a better chance than a 14-inch one, by leaving him more room to work ; while a 14-inch lantern is not large enough for a No. 3 or No. 4 burner. Some tin chimneys or protectors were given out for the use of the cleaners at first ; but after a little practice they proved to be unnecessary, except for naked mantles. Two out of three of our lamps are now fitted with glass bulbs which serve the purpose of a protector, both in respect to the arm of the cleaner and to a passing gust of wind.

Having observed the precautions indicated as necessary in the preceding remarks, there is no difficulty whatever in reducing the consumption of mantles to a reasonable limit—well below six per lamp per annum. The cost of mantle renewals is not a serious item. In addition to this there is the burner to be cleaned occasionally ; so the cost of maintenance may be put at 5s. or 6s. per lamp in excess of the similar figure for flat flame burners. Against this there is the saving of gas. A No. 2 new pattern Welsbach burner does not consume more than 2½ cubic feet per hour, or less than half the quantity required to supply a 5-cubic feet flat flame, which really comes out in practice to nearly 6 cubic feet per hour. On a 3,700 hours schedule, the flat flame burner will require 20,000 cubic feet per annum or more; but the incandescent only just over 9,000 cubic feet. So it is quite safe to introduce the new system at a less price than the old ; and the authorities will, under ordinary circumstances, be only too pleased to take out the reduction in additional lamps.

Although higher pressure and increased consumption are attended with an increase of illuminating power, whereas with the ordinary flat flame there is a positive decrease of light, under similar circumstances, the "duty" per cubic foot of gas used is not increased. The best results, so far as economy in consumption of gas is concerned, are shown at about the nominal rate for which the burner is constructed. With a No. 2 burner, adjusted to 2 cubic feet per hour, a duty of 33 candles can be obtained ; but if the pressure is increased to give a consumption of 2.75 cubic feet per hour, the illuminating value will be under 80 candles—representing a duty of less than 30. It is important to bear this in mind, because the statement that the illuminating power increases with the consumption has been read as meaning that the "duty" increases, which is a different thing. And some have supposed that the best results are obtained at the highest possible pressure, which is not the case.

The Cast Iron Pipe Combination and the Anti-Trust Law.

By "W. L. C.," in *Iron Age*.

The United States Supreme Court recently has heard the argument both for the Government and the defendants in the appealed case of the United States *vs.* the Addyston Pipe and Steel Company, *et als.*, involving the right of industrial corporations to enter into agreements to prevent so-called "ruinous competition." The other defendants in the case are Dennis Long & Co., of Louisville, Ky.; the Howard-Harrison Iron Company, of Bessemer, Ala.; the Anniston Pipe and Foundry Company, of Anniston, Ala.; the Chattanooga Foundry and Pipe Works, of Chattanooga, Tenn., and the South Pittsburgh Pipe Works, of South Pittsburgh, Tenn. The case has attracted an unusual amount of attention for the reason that it is the first of its kind to reach the Supreme Court, and the decision of that tribunal will have an important bearing upon trade combinations and agreements throughout the country.

The case arose in the Circuit Court of the United States for the Eastern District of Tennessee upon a suit brought by direction of the Attorney-General of the United States against the defendant corporations to restrain them "from continuing to violate the act of July 2, 1890 (the so-called anti trust law), by operating under an alleged illegal combination." The corporations cited were engaged in the manufacture of cast iron pipe used chiefly by municipal and other corporations for gas, water, sewer and other purposes. The petition of the Attorney-General alleged that the defendants were the only persons engaged in manufacturing cast iron pipe who have the capacity to supply the demand in 36 States and Territories named, being those West of New York and Pennsylvania and south of Virginia. The defendants, it was alleged, "in order to monopolize the trade in cast iron pipes in the above territory, and force the price to an unreasonable rate and destroy all competition, on December 28, 1894, entered into a contract or combination in the form of a trust or conspiracy in restraint of trade or commerce among the several States and Territories named in regard to the manufacture and sale of cast iron pipe, the name of the conspiracy being The Associated Pipe Works."

The trade of certain cities was by the agreement divided among the several companies, all other sections of the country being classed as "pay territory." It was further alleged that in order to prevent competition in the pay territory the agreement between the companies provided that a bonus should be charged by the combination against the individual company for every ton of pipe sold by them in the territory described, the amount of such bonus being determined "by how much the combination could force the customers to pay." A bonus ranging from $3 to $9 had been paid by the individual companies to the combination during a stated period, which amount represented, as alleged by the Government, "the amount charged for pipe over and above a reasonable and fair price for the same, and above the price that defendant would be willing to sell for if the trust or combination did not exist." The output of the six shops, it is alleged, amounted to 220,000 tons, which paid an average of $6 per ton bonus, thus providing the combination with annual receipts of at least $1,320,000. The combination was operated, according to the evidence, by a committee composed of one representative of each of the defendant corporations, to whom all orders for pipe were referred. It was the practice at the outset for the members of the committee to allot the contracts to the company best equipped for the special work, in return for which the said company were compelled to pay to the combination the bonus per ton referred to. Where bids were solicited by municipalities and others requiring pipe the company to whom the contract was alotted by the committee would bid thereon the price agreed upon, the other companies bidding higher prices in order to protect the foundry to which the work had been assigned. Subsequently this feature of the combination was modified and the contracts were allotted to the company agreeing to pay to the combination the largest bonus. The details of the organization and operation of the combination were secured by the Attorney-General through a confidential employee of the combination, who, in his capacity as a stenographer, recorded the minutes of the meetings and subsequently betrayed his employers' confidence by supplying copies of all documents to the Government. The general form of the combination and its method of operation substantially as charged by the Government were admitted by the defendants, but it was denied that the arrangement was illegal or that it operated as a restraint of trade on interstate commerce, either as contemplated in the common law or in the act of July 2, 1890, as alleged. The United States Circuit Court, in which the petition was originally brought, dismissed it, but the Circuit Court of Appeals reversed the judgment of the court below and remanded the case, "with instructions to enter a decree for the United States perpetually enjoining the defendants from maintaining their combination in cast iron pipe described in the bill and substantially admitted in the answer, and from doing business thereunder." The defendant companies thereupon appealed to the United States Supreme Court, where argument has just been concluded.

Solicitor General Richards, who represented the Government before the United States Supreme Court, based his argument upon the proposition that it was quite as much the purpose of the so-called anti trust law to protect the public against persons and corporations who might seek to suppress competition as to prevent the establishment of absolute monopolies. Congress had doubtless exercised the full limit of its powers in vesting in the courts the authority to deal with such combinations, but there could be no doubt of the constitutionality of the statute, though the present was the first case in which there had been an opportunity to fairly test in the highest court the powers of corporations to combine for the express purpose of regulating trade and controlling prices.

"The agreement entered into by the defendant corporations," said Mr. Richards, "is in restraint of trade because it suppresses competi-

tion and arbitrarily fixed prices. It does this with respect to a commodity, cast iron pipe, mainly used for public purposes and purchased by municipalities at public lettings after advertisements for bids; and it does this while fraudulently retaining a show of competition for the purpose of deceiving the public. The trade or commerce thus restrained is trade or commerce among the several States, and the agreement regulates such trade and directly affects it, putting a restraint upon the trade among the several States in cast iron pipe which affects competition and interstate sales and the prices to be charged for the commodity.

"Even if the anti trust law applied only to contracts in unreasonable restraint of trade this agreement must fail because it is unconscionable. No court ever sustained such an agreement, which is not only a combination to throttle competition, but a conspiracy to defraud the people in the letting of public contracts. The answer of the members of this combination says that 'Previous to December 28, 1894, defendants had bid on such occasions against each other and other companies proposing to take such contracts, and the competition provoked by this method of dealing secured to gas, water and municipal corporations the advantage of ruinous competition to the bidders while said bidders had no other market in which to dispose of their product.' This was the situation to be met, and although the law required open competition in the letting of these contracts by municipal corporations, the defendants formed this combination to circumvent the law. In other words, the purpose of the combination was to prevent 'ruinous competition.' All such combinations are formed for that purpose. Here is a frank expression. The object of the association from the first was to guard against and suppress the open competition which the law demanded. In the original plan the pay territory, so called, was the competitive territory in which these shops were the principal source of supply. It covered more than three quarters of the United States, and on every contract in this territory the shop that secured it had to pay from $1 to $4 a ton to the association for distribution among the shops according to their estimated tonnage capacity. The requirement of a bonus was to remove the motive for competition. The division of the bonus was a division of profits. The company that have to share their profits are not so eager to do the work. The pooling of freight and the division of earnings were prescribed by the anti-pooling provisions of the Interstate Commerce act, because they are used to suppress competition and maintain arbitrary rates. The fixed bonus plan was, so far as it went, a provision for the division of profits. Its object was to suppress competition and maintain arbitrary prices.

"Along with the fixed bonus provision went the reserved cities plan. The leading cities in the territory were divided up among the shops. These cities, in every one of which the law required contracts for cast iron pipe to be let after advertisement upon open competition, were parceled out among the members of the association. The shop that owned the city fixed the price. It notified the other shops of its price and they had to protect it by bidding over. This was a deliberate conspiracy to deceive and to defraud. The city authorities supposed they were getting genuine bids. They supposed there was the competition which the law requires. They were deceived. There was no competition. The matter was all fixed up beforehand. The bids were collusive and fraudulent. The contract secured was illegal and void. And it was to do this sort of thing that the combination was formed.

"But the fixed bonus plan did not result 'in the advancement of prices of pipe as anticipated,' and so the auction pool plan was adopted. Under this plan 'all competition on the pipe lettings shall take place among the various pipe shops prior to the said letting.' To accomplish this all inquiries for pipe were to be referred to a board composed of one representative from each of the six shops. The board fixed the price of the pipe and then the representatives bid against one another for the order, the shop offering the biggest bonus to get the job. The auction pool resolution provided 'the party securing the order shall have the protection of all the other shops.' In other words, all the other shops were to bid over the price fixed by the board. The defendants say 'the price agreed on did not, in fact, fix or regulate the price at which contracts were obtained, but was only adopted as a fair price, and constituted a basis upon which the defendants could intelligently compete among themselves and determine who should endeavor to secure the contract.' This was indeed intelligent competition—the intelligence of the gang that loots the public by deliberate prearrangement.

"As to the point whether the trade or commerce restrained by the agreement or combination was trade or commerce among the several States there can be no doubt. The agreement regulates such trade and directly affects it. The restraint is not an indirect result of the agreement. The manifest intention of the combination was to put a restraint upon trade among the several States in cast iron pipe. The restraint was upon competition, and directly affected interstate sales and the prices to be charged at interstate sales. The natural operation of the law of competition in interstate business among these six shops, located in four different states and operated in a pay territory composed of 36 States, was purposely and intentionally restrained and suppressed by this arrangement. It is impossible to suggest a contingency in which the agreement would have a purely local operation. Even in the case of a local sale by the Addyston Company of pipe to Cincinnati there would be a restraint upon interstate trade because the agreement prohibits the other five shops located outside of Ohio from bidding on such a contract—that is, from selling their pipe to Cincinnati. Such a sale by a shop outside of Ohio to Cincinnati would be interstate commerce; therefore the agreement puts a restraint upon such commerce. Moreover, in every instance there is an interference with the law of competition and an arbitrary regulation of the price to be charged.

"I submit that a combination among great manufacturing corporations located in different States which divides up the territory of the United States, leaving a portion of it open to the law of competition and suppresses competition in all the rest, permitting prices to be fixed by natural laws in certain States and arbitrarily fixing the price itself in other States, is condemned by the anti-trust law and ought to be declared illegal by this court."

In reply to the contentions of the Government the defendant corporations, who were represented by F. V. Brown, Frank Spurlock and John W. Warrington, declared that the Government had failed to prove any of the allegations of the petition except the existence of the association, which was admitted. The defendants denied, in the first place, that the companies named were the only ones situated in the territory described, but on the contrary averred that there were a number of other similar works in said territory, and some of them with respect to a large part of said territory better situated for securing advantageous freight rates. The other companies in the same territory had a larger daily capacity than the aggregate daily capacity of all the defendant companies, and there were still other works outside of said territory which sell pipe in all the States of the Union, some of them alone having a greater capacity than all the defendants combined. No sales of pipes were made as manufacturers usually dispose of their products, but all the pipe was manufactured and delivered under contracts which had previously been let to the lowest bidder after advertising for bids and inviting the competition of all companies in the United States. This method brought all the pipe companies into active competition for each contract to be let to the lowest bidder, and gave to gas, water and municipal corporations the advantage of buying at the ruinous competition of the bidders, which resulted in preventing the establishment of fair market prices and arrayed each pipe company against the others, with strong motives not only to underbid, but otherwise to injure each other.

The purpose of the competition, it was maintained, was simply to secure among themselves a fair distribution of the contracts which in competition with other concerns whom they did not control they might be able to maintain. The price as between the company securing the contract and the customer was always fair and reasonable, and was fixed, not by the combination, but by competition from companies outside of the association which could and did put in bids on all the contracts let. These contracts could only be secured when one of the associate companies put in the lowest bid. It was expressly denied that this agreement was intended to or did restrain or monopolize interstate trade or commerce or any part thereof, or that it was under the peculiar circumstances an unreasonable restraint on the competition that would otherwise exist between the defendants.

"We therefore insist," said counsel for the defendants, "that the government, having failed to prove the allegations in the petition, except the existence of the association, the only question for consideration is whether that agreement of itself for the purposes as shown by appellants constitutes a monopoly or contract in restraint of interstate commerce. By the terms of the contract each of the applicants were left in full ownership and management of their plant. There was no central committee or board having power to control the business affairs or works of these combinations. The pipe manufactured and shipped was always the exclusive property of the company who manufactured and sold it. Neither of the other companies, either singly or collectively, had any interest in pipe manufactured and sold by either of the defendants. But the agreement did provide that whenever either of the parties thereto secured the contract in certain territory the others were to share in this price to a certain extent, the remainder of the price being the exclusive property of the selling company. When the bonus was

agreed upon and the member selected to make the bid the association compact had accomplished its purpose, and it was thereafter that the contract was let as advertised and bid on by the selected member of the association. If this bid was the lowest the contract was secured and the pipe manufactured and delivered in accordance with the terms thereof. If an outside manufacturer put in a lower bid, as often happened, the contract was not secured. There was no contract between the buyer and the purchaser of goods either involving or not involving shipment from one State to another until after the contract was awarded and the Association compact had ceased to operate. There was not until this time any kind of contract between bidder and seller involving either domestic or interstate commerce. The bids were usually opened in the presence of the bidder, but whether so or not the contracts were advertised, let, executed and performed under local regulation, State and municipal. If the foundry of the successful bidder was in a different State from that in which the contract was secured, it was necessary after the pipe was manufactured to ship it to the place of delivery. It was when shipped the exclusive property of the company, and while the other members of the association had been credited with a certain portion of the selling price, this had either then been paid or at least only stood as a charge against the seller independent of his contract with the purchaser, and in no manner affected the ownership of the pipe."

In conclusion, counsel for defendant said: "This agreement was nothing more than an ordinary partnership, and was protected under the law protecting all legitimate contracts. The defendants had as much right to make contracts among themselves as other citizens had, so long as they did not interfere with the rights of others, which this agreement did not. As to the contention of the government that the combination was in violation of the interstate commerce clause of the the Constitution, it should be said that that clause was intended only to apply to restraint on commerce between the States by the various States themselves, or by municipalities or common carriers between the States. Hence a union of interests like that of the defendants did not fall with in the inhibition of the Constitution, and the laws under it could not be invoked legitimately to disturb the relationship. The far-reaching effects of the denial of the rights of the defendants to do as they have done are manifestly obvious. If manufacturers could not do so then no class of producers or merchants could enter into such an arrangement, no matter how small their number or how slightly or indirectly its execution might restrain interstate trade or commerce. Farmers could not do so in respect to wheat, corn or other cereals grown upon their separate farms for their own profit or even livelihood. So of cotton growers. So of growers of live stock. So of persons engaged in commercial pursuits respecting any sort of articles intended only for private use or consumption."

It is anticipated that the Supreme Court will hand down its decision in this interesting case before adjourning for the summer recess.

A New Form of Wehnelt Interrupter.

Mr. Elihu Thomson, in describing a form of Wehnelt interrupter which was devised by himself and Mr. Robert Shand, declares that it possesses the merit of embodying in one device, resembling somewhat a pencil, both anode and cathode. It is easily made, and the results obtained thus far with it are very good. As pointed out, also, it can be made adjustable—*i. e.*, the extent of platinum surface exposed to the liquid may be varied. The device can be dipped into an ordinary bottle containing acid, or into any other suitable vessel.

Fig. 1 is a photograph of two interrupters of a form described herein. A heavy, straight copper wire, 6 or 8 inches long, is provided, with a platinum wire of much smaller gauge projecting from one end. This is encased in a rubber covering, which may be hard rubber or soft rubber. The hard rubber, however, is best for the tip from which the platinum projects. Outside of the rubber coating there is a casing or tube of lead extending from one end to the other except for a short space around the anode of platinum, and for a space of, say, one-half inch or more at the other end of the rubber. The lead covering is thus insulated from the copper wire and platinum anode, and the said lead covering is provided with a connection, such as a binding post, by which it is made cathode. The copper wire is also tipped with a binding post connection, which is made anode. To facilitate suspension in the liquid a flange, which may be merely a rubber ring slipped over the lead, is provided near the top.

Referring to Fig. 2, the manner of using this form of interrupter is there shown. An ordinary glass jar or bottle *J*, contains the acid, and through the neck or through the stopper or cap the interrupter is inserted as seen, the platinum anode being at *A*; the lead covering or cathode being shown at *L* supported by a layer of rubber interior to the lead. The binding posts are marked plus and minus. The figure also

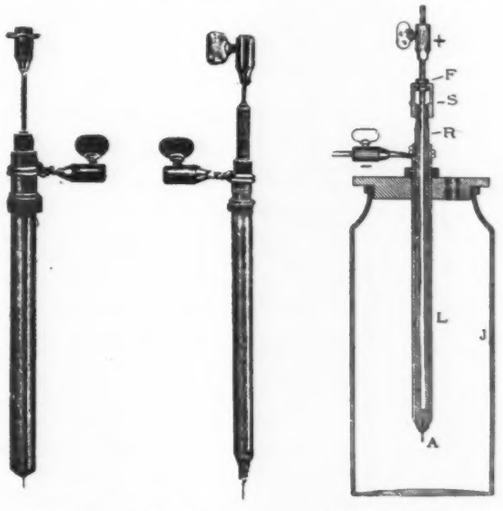


Fig. 1.—Two Interrupters. **Fig. 2.**—Manner of Using.

shows the anode *A* adjustable. The screw nut or sleeve *S* surrounds the projecting rubber *R*, which is screw-threaded, and a pair of small flanges projecting from the central wire *C* engage with the sleeve so that by turning the sleeve *S* the copper wire *C* is moved up and down and the platinum *A* projects more or less through the rubber tip which is tightly fitted to it. This form of interrupter is quite neat in appearance and very easy to manipulate.

Text of the Petition in Equity of the Louisville Gas Company against the Kentucky Heating and Lighting Gas Company of Louisville, Ky.

The following is the text of the petition in equity presented by the Louisville Gas Company to the Jefferson Circuit Court against the Kentucky Heating and Lighting Gas Company, of Louisville, Ky.—this matter was referred to editorially in the JOURNAL for the 1st inst.:

The plaintiff, the Louisville Gas Company, states that it is a corporation duly created by and existing under the laws of the State of Kentucky. Its charter is contained in an act entitled "An act to incorporate the now existing Louisville Gas Company and grant it a new charter," passed by the Legislature of Kentucky, and approved March 16, 1888; and in two amendatory acts—one entitled "An Act to amend the charter of the Louisville Gas Company," passed by the Legislature of Kentucky, and approved April 26, 1890; the other entitled "An Act to amend an Act entitled 'An Act to incorporate the now existing Louisville Gas Company and grant it a new charter,' approved March 16, 1888, and grant said Company the right to manufacture, distribute and sell electricity," passed by the Kentucky Legislature, and approved May 3, 1890.

The substance and effect of these Acts, granting to the plaintiff its charter, are for the purposes of this case, as follows:

The term of charter life is from January 1, 1889, for 30 years thereafter. The Company has powers to purchase, hold and enjoy such property, real, personal, and mixed, buildings, machinery, patents, apparatus and other things, as may be deemed to be proper or necessary to the successful prosecution of the business of making, storing, distributing and vending gas in the city of Louisville and its suburbs. It has full power and authority to manufacture and vend gas to be made from any and all of the substances, or a combination thereof, from which inflammable gas can be obtained.

By the 4th section of its charter it was declared that this plaintiff should succeed to and become the owner of the property, securities and effects of the then existing Louisville Gas Company; and to enable the plaintiff to construct, continue and extend its gas works and capacity, to manufacture, distribute and deliver gas in the present or future limits of the city of Louisville and its suburbs, it was authorized to continue the use of its buildings, works, apparatus, machinery, mains, service pipes and other property employed in manufacturing, distribu-

ting, storing and delivering gas prior to January 1, 1889, and from and after that time to own and extend the mains, conductors, service pipes and works into and through all the streets, alleys, parks, roads and ways of said city and its suburbs.

By its charter the plaintiff was required to furnish to all consumers —private and public—gas of an illuminating power of not less than 16 candles, English sperm, and of the best quality of said power; the same to be tested by a City Gas Inspector, to be appointed in pursuance of the provisions of the charter; and the plaintiff is required to fully and freely permit the gas inspector to test and inspect the gas, gas meters and pressure at any and at all times.

By Section 10 of its original charter it was provided as follows:

"Said Company shall have the exclusive privilege of erecting, maintaining and operating gas works in the city of Louisville, for the manufacture and sale of gas for illuminating and heating purposes during the continuance of this charter; reserving, however, to any person the right to erect gas works on his own premises for supplying said premises with gas for his own use; provided that this section shall not be held to exclude the introduction and sale of natural gas for fuel, heating and illuminating purposes, or of erecting and maintaining the necessary works and appliances for the storing, distributing, conducting, general utilization and sale of natural gas for purpose of illuminating and heating."

By an amendment to its charter (being the first above mentioned) it was provided, in Section 1 of said amendment, as follows:

"That the 10th section of the charter of the Louisville Gas Company be and the same is hereby so amended and modified that the word exclusive in said section shall only apply to the manufacture and sale of illuminating gas for illuminating and for heating purposes."

By the 11th section of its original charter, the plaintiff is required to put lamp posts along the streets as the gas mains are extended, at a distance of about 200 feet, and where there are mains on both sides of the street, to locate the lights so as to alternate; to furnish gas for said lamps at the rate of at least 5 cubic feet per hour to each burner, and to light and extinguish the lamps; the time for lighting and extinguishing to be fixed annually in January by the City Gas Inspector, on the basis of 4,000 hours' burning per annum; to keep the lamps clean, in order and repair, and to charge the city therefor $20 per annum for each lamp used.

By the 12th section of its charter the plaintiff is required to furnish illuminating gas to private consumers who may apply therefor, under reasonable rules and regulations, to be prescribed by the plaintiff, at a price not to exceed $1.35 per 1,000 cubic feet, less a discount of 5 cents per 1,000 cubic feet, to all persons, including the city (except as to street lamps) paying their bills within 5 days after same are due.

Charges Fixed.—Its charter provides that the prices fixed by the sections stated above shall only apply for the years 1889 to 1893, both years inclusive, and that during the year 1893 and prior to October, the price of gas to the city, per lamp post, and to the private consumer, per 1,000 cubic feet, shall be fixed by a board of arbitration, composed of three civil engineers—one selected by the Mayor of the city of Louisville, with the approval of the General Council; one by the Directors of the plaintiff, and the other by the two so chosen. This board of arbitration is to have full access to all the books of the Company. It is to make a report, in writing, to the General Council and to the plaintiff, and the prices fixed by this Board shall be conclusive and binding for the years 1894 to 1898, both inclusive; and it is provided that the same proceedings shall be had in the years 1898, 1903, 1908 and 1913, before October 1 of each of said years, to fix the prices for the several periods of 5 years next succeeding.

It is further provided that in fixing the price of gas per lamp post, it shall be the duty of the Board of Arbitration to fix the same as nearly as possible at the cost of gas consumed and the maintenance thereof; and in fixing the price of gas per 1,000 cubic feet, for private consumers, it is made the duty of the Board to fix the same so as to yield a profit of 8 per cent. per annum on the par value of the stock; but that the price of gas to private consumers, including the city (except as to street lamps), shall never exceed the maximum rate above named for the first 5 years, nor more than will yield the Company the 8 per cent. profit hereinbefore stated.

By the 13th clause of the original charter it is provided that the plaintiff shall, until its capital stock is exhausted, extend its mains beyond the point of present extension, upon the request of the General Council of the city of Louisville, or of the residents upon the streets to which such extension is desired, when the profits on the gas furnished for the public and private lights, arising from such extension, will yield 6 per cent. on the cost thereof; or when the Company shall be guaranteed that profit on the cost of such extensions, by the residents upon the streets so supplied with gas.

By the 19th section of its charter there is a provision giving to the city of Louisville a right, at the termination of the charter, to purchase the entire gas works, property and effects of the said Company.

The 20th section of the said charter is as follows:

"This charter shall not be altered, amended or repealed without the concurrence of the General Council of the city of Louisville and the Board of Directors of the Louisville Gas Company; provided that this section shall not apply to section 14 of this act, and provided that a violation of any of the essential provisions of this charter shall cause a forfeiture thereof."

The section 14 referred to is the one in reference to taxation.

The two amendments passed to the charter of the Company were both assented to by the Board of Directors of the plaintiff and the General Council of the city of Louisville. The only provision in either of said amendments, germane in any way to this controversy, has been heretofore stated.

The plaintiff states that since January 1, 1889, it has been in the full operation of the powers, and has fully performed the duties set forth in the said charter; and the same is true in reference to the powers and duties in the said amendments from the time they were passed.

The Rock Gas Company.—The plaintiff further states that heretofore the Legislature of the State of Kentucky, by an act approved March 26, 1888, entitled "An act to incorporate the Kentucky Rock Gas Company," chartered a Company under that name.

By the 6th section of that act the corporation thereby created was authorized to purchase, lease, acquire, use, transfer and hold lands and property for the purpose of obtaining, using, vending and utilizing natural gas, salt water, petroleum, clay, sand, stone, cement, coal, iron, lead and other substances; to bore, dig, mine, quarry and excavate for any and all of said substances; to erect and operate, upon its lands and property, manufactories, warehouses, shops, tanks, reservoirs, furnaces and necessary machinery, buildings and works for the purpose of obtaining, using, selling, utilizing and rendering profitable, by use or sale, all or any of said substances; and to lay pipes and conduits and make roads and ways upon said lands and property for the purpose of conveying and moving said substances from one part of said lands and property to other parts thereof; "and to the end that such corporation may carry and conduct natural gas, salt water, petroleum or other fluid substances from the lands and property it may own or control, to any cities and towns or manufacturing and business places of this Commonwealth wanting the same and assenting to their introduction, on terms and conditions to be agreed upon, and there use, sell and dispose of the same, said corporation is hereby empowered to acquire, after paying a reasonable compensation therefor, the use of any land it may need to lay its pipes and conduits to convey natural gas, salt water, petroleum or other fluid substances from its lands and property, to any cities, towns, manufacturing and business places in this Commonwealth wanting the same and assenting to their introduction and use, by writ of *ad quod damnum*, as provided for in article 2, chapter 96, of the general statutes of Kentucky."

By another clause of its charter it was provided that the corporation should have the right to borrow money and issue coupon bonds, and "to secure the payment of the principal and interest of any such bonds as may be issued, such corporation is hereby authorized to mortgage its lands, leases, property, franchises, privileges and rights, and to establish a sinking fund to liquidate the debt at or before maturity."

By an act entitled "An act to amend an act entitled 'An act to incorporate the Kentucky Rock Gas Company,'" approved April 3, 1890, it was provided that the said Kentucky Rock Gas Company should be authorized to manufacture and sell fuel gas for heating purposes, with the same rights, privileges and powers granted in its charter for obtaining and selling natural gas.

By an ordinance of the General Council of the city of Louisville, approved August 11, 1888, entitled "An ordinance granting the Kentucky Rock Gas Company the right to lay down its pipes and mains for fuel and heating purposes in and along the streets and alleys of the city of Louisville," it was provided, in Section 1, that the said Kentucky Rock Gas Company "is hereby granted the right and privilege and authority to lay down its pipes and mains in and along all the streets, alleys and public ways of the city of Louisville, and make such other connections and arrangements as may be needful and necessary for the supplying of natural gas to the citizens of said city for heating purposes only, for a period of 20 years from the date of the passage of this ordinance, upon the following express conditions, to wit:

"1st. Any and all pipes, mains and connections in and along the

public alleys or public ways shall be laid subject to the regulations of the General Council, and under the supervision of the City Engineer.

"2d. That said Company shall furnish natural gas for fuel or heating purposes to the citizens or city by contract made between the parties.

"Said Company shall proceed as rapidly as practicable to establish its works and lay down its pipes and mains after the passage of this ordinance; provided the said Company shall have erected such works as may be necessary and have laid its mains and be prepared to supply the citizens with natural gas for the purposes aforesaid within two years after the passage of this ordinance; and upon its failure to do so the rights hereby granted shall be forfeited."

The Kentucky Rock Gas Company executed a mortgage upon its property and franchises. This mortgage was foreclosed and the property and franchises purchased by certain persons, who conveyed the same to the defendant, the Kentucky Heating and Lighting Gas Company.

Powers Given Defendant.—The defendant, under this name, is a corporation created June 1, 1891, by articles of association filed under what was known as Chapter 56 of the General Statutes of Kentucky. These articles of association provide that the corporation shall have power to acquire, hold and transfer property—real, personal and mixed—to the same extent as private individuals are allowed so to do; to acquire natural gas by boring, drilling or other processes on lands obtained for the purpose, or to purchase said gas from other companies and individuals; and to sell said gas or use it for its own purposes; and to manufacture artificial gas from any substance suitable therefor; and to sell and use the same; to lay pipes for the purpose of conducting its gas from the places where it is obtained to other points, for use and sale; to erect all necessary machinery and appliances for the collecting, storing and distributing thereof; to acquire the right of way for its pipes, and to lay the same; to establish such connections as may be necessary and convenient for the proper vending and distribution of its said gases; to exercise any power or franchises acquired by it under the 5th and 7th sections of its articles of incorporation.

By the 5th section of its articles of incorporation it is provided that the said corporation shall have power to acquire the property and franchises of the Kentucky Rock Gas Company, as the same may be sold under any decree of foreclosure of the deed of trust upon the franchises and property of said Company.

By the 7th section it is provided that the corporation may acquire stocks and bonds in other corporations and "the property rights and franchises thereof, upon such terms as may be agreed upon by the Board of Directors of this corporation (the defendant)."

By the 8th section it is provided that with the consent of any city or town in the State of Kentucky such corporation may open the streets, alleys, sidewalks and public grounds and lay its pipes for conducting and selling its gas to consumers; and may erect and operate within the corporate limits of such city or town the necessary machinery, buildings and apparatus to enable it to store and distribute natural gas; and also to manufacture, store and distribute artificial gas.

By the 12th section of the articles of incorporation it is provided that said corporation may make and sell salt, soda ash and any other article germane to its property and business, and erect such machinery, apparatus and appliances as may be necessary to the manufacture and vending of the same.

The plaintiff states that in pursuance of its public duty it has laid its pipes and mains under a large number of the streets and alleys and highways of the city of Louisville, the said pipes being now 158 miles in total length; that it has expended large sums of money in the erection and maintenance of the proper machinery and apparatus for the production, storage and distribution of its gas; that it supplies, wherever it is desired by the city, along its mains, light for the streets and other highways, at the prices fixed in its charter, and that it supplies to consumers gas according to the prices so fixed. It has extended its mains whenever called upon to do so, under the terms and provisions of its charter, so that it now reaches, with its pipes and mains, all parts of the city of Louisville except such outlying districts as are so sparsely settled or have been so recently included within the corporate limits that it has never yet become the duty of the plaintiff to extend its mains into them.

There are many parts of the city in which its mains have been introduced where it is not profitable to distribute gas, the demand being too small to justify the expense of laying pipes and distributing the gas That part of the territory of the city of Louisville which yields the largest returns to a gas company is the central and most thickly settled portion; and if plaintiff's public duty could be performed by furnishing these districts alone, it could easily earn the profit for its stockholders up to the limit allowed by its charter; and, besides this, greatly reduce the price of its gas to such consumers. As it is, the plaintiff says that never since it began operations has it been able to make the amount of dividend allowed to it by law, but for some periods has only been able to distribute as low as 4 per cent. per annum—which is only half the amount allowed under the charter.

The plaintiff further states that the city of Louisville is largely interested in it, owning of its capital stock the sum of———, counting the stock at par; and under the charter has the right and exercises the power to appoint four out of the nine directors of the plaintiff.

The plaintiff further states that the defendant is without any right or authority whatsoever to lay or maintain any pipes or conduits in, through or under any of the public streets, alleys or highways of the City of Louisville, except as it may have acquired the rights granted to the Kentucky Rock Gas Company by the ordinance above mentioned, approved August 11, 1888. That ordinance expressly limited that right to such as might be needful for the supply of natural gas to citizens or city for heating purposes only; thus imposing two restrictions: That the gas should be natural gas, and that it should be used for heating purposes only.

The plaintiff states that said ordinance was thus passed and restricted by the General Council of the City of Louisville, because of the exclusive right which the plaintiff had granted to it by its charter passed March 16, 1888, and prior to the passage of the said Kentucky Rock Gas charter, and because of the interest of the city of Louisville in the plaintiff, and because of the public duties and burdens laid upon the plaintiff by its charter—none of which were laid upon the said Kentucky Rock Gas Company.

Its Rights Invaded.—Notwithstanding these facts the plaintiff states that the said defendant, the Kentucky Heating and Lighting Gas Company, has, without warrant of law and in violation of the rights of this plaintiff, engaged in the business of the manufacture and sale of gas in the city of Louisville for illuminating and heating purposes; and the plaintiff says that the said defendant sends through the pipes laid, without authority of law other than the ordinance aforesaid, natural gas for illuminating purposes, and also artificial gas for heating purposes; and also manufactures and sells, in the city of Louisville, illuminating gas for heating and illuminating purposes.

And the plaintiff further states that the said defendant gives out to the public that it is prepared to sell gas, both natural and artificial, for illuminating purposes, at a price lower than that charged by the plaintiff; that the said defendant has laid its pipes through those streets in the city of Louisville where the population is dense and where the consumption of gas is very large; that it has not extended its mains generally through the city nor into any of the less densely populated parts of the town; that the defendant has in all only about 12 or 14 miles of pipe, as against the 158 miles of the plaintiff; that the defendant is seeking to appropriate to itself the custom only where it will be largely profitable, relying upon the plaintiff being compelled, under the duties imposed upon it by its charter, to furnish gas where the profit is smaller or there is no profit.

Plaintiff states that the said defendant is proceeding in the distribution of its gas through the pipes laid in the streets and public ways of the city of Louisville, without any warrant of law and in violation of the only authority which it claims to have, to the great detriment and injury of this plaintiff; and is also, to the great detriment and injury of this plaintiff, violating the exclusive privilege belonging to this plaintiff and conferred upon it as aforesaid, in consideration of public services undertaken to be performed and being performed by it; that the said defendant is, from time to time, manufacturing large quantities of illuminating gas and selling the same in the city of Louisville and to citizens thereof, for illuminating as well as for heating purposes, and in so doing is violating the exclusive privilege given to the plaintiff as aforesaid. And plaintiff says that the said defendant is from time to time erecting, maintaining and operating gas works in the said city of Louisville, for the manufacture and sale of illuminating gas for illuminating and heating purposes. And the plaintiff further says that the said defendant is threatening to continue in the commission of all of the wrongs alleged above as being committed by it, and of greatly increasing the same. And the said defendant is now threatening without authority of law, as aforesaid, to lay additional pipes, and is threatening to erect, maintain and operate greatly larger works for the purpose of the manufacture and sale of illuminating gas for illuminating and heating purposes.

Claims a Vested Right.—Plaintiff further says that if for any reason the said defendant's charter can be construed into authorizing it to commit any of the aforesaid wrongs, or to violate in any way the ex-

clusive privilege conferred upon this plaintiff, the same, and the act under which the said articles of association are formed, are in violation of the Constitution and laws of this State and of the United States, as impairing the obligation of plaintiff's contract; and the same is true of the charter of the Kentucky Rock Gas Company as amended if the same can be construed as authorizing the said wrongs. And the plaintiff says that if the defendant is in the lawful exercise of the franchises of the Kentucky Rock Gas Company, and the said franchises authorize the defendant in any way to violate the exclusive privileges belonging to the plaintiff, the same is contrary to the Constitution of the State of Kentucky and of the United States, and particularly the clause in said latter Constitution, prohibiting the impairment of contracts.

Plaintiff states that the wrongs committed and threatened by the defendant herein, as hereinbefore set out, are such as are irreparable, and for which there is no adequate relief in a suit at law, and that the said wrongs throw a cloud upon the rights and franchises of the plaintiff; diminish the profits legitimately belonging to the exercise of its franchises; make its burdens greater; deprive it of a large amount of business to which it is justly entitled, and prevent it from serving the public in a way which would be cheaper to the public; prevent it from reducing its price of gas to public and private consumers (which it otherwise could do if its business and profits were not taken from it by the defendant, as above stated), and cause the plaintiff great and irreparable injury and loss.

The plaintiff files herewith, marked "Exhibit A," a copy of its charter and the two amendments thereto hereinbefore set forth; a copy of the charter and amendment thereto of the Kentucky Rock Gas Company, marked "Exhibit B;" a copy of the ordinance of August 11, 1888, hereinbefore described, marked "Exhibit C;" a copy of the articles of association of the defendant hereinbefore referred to, marked "Exhibit D," and makes all of them parts of this its petition.

Wherefore, the plaintiff prays that it be quieted in its title to its rights, franchises and privileges as hereinbefore set out; that the defendant be perpetually enjoined and restrained from sending through any of its pipes laid in the city of Louisville gas other than natural gas, and from sending natural gas through the said pipes for purposes other than heating; and from erecting, maintaining or operating gas works in the city of Louisville, for the manufacture or sale of illuminating gas for illuminating or heating purposes, during the continuance of the charter of this plaintiff; and from vending or offering to vend artificial gas for heating or illuminating purposes, and from laying any pipes or mains along or through any of the streets, alleys or public ways of the city of Louisville, for the purpose of distributing or selling artificial gas for illuminating or heating purposes; and from throwing a cloud upon the rights, privileges and franchises of the plaintiff as hereinbefore set out; and for its costs and all general and equitable relief. HUMPHREY & DAVIE, for plaintiff.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

MR. J. B. KLUMPP, Executive Clerk, United Gas Improvement Company, informs us that the Company will move into its new office building, Broad and Arch streets, Philadelphia, to day.

MR. W. R. PUTNAM has been appointed Secretary, Treasurer and Manager of the Red Wing (Minn.) Gas and Electric Company.

THE proprietors of the Peoples Gas Light and Coke Company, of Chicago, have declared a regular quarterly dividend of 1½ per cent., payable the 25th inst.

DR. W. F. ACTON is authority for the statement that the gas plant of the combined gas and electric lighting interests of Norwalk, Conn., is to be rebuilt.

SUPERINTENDENT GEORGE M. STARR, of the Wallingford (Conn.) Gas Light Company, is hard at work improving its distributing plant. The Company will remove to suitable office quarters in the Wallace building, on Center street, as soon as the refitting of the rooms rented is completed.

THE City Council, of Knoxville, Tenn., has passed an ordinance directing the Knoxville Gas Light Company to charge not in excess of $1 per 1,000 cubic feet on illuminating account and 75 cents per 1,000 for a fuel use. We further understand the Council to have declared that if the Company refuses to accede to the provisions of the ordinance, a franchise will be granted to parties for the operation of an opposition gas plant, which parties have declared their willingness to furnish gas at the rates named.

MR. W. P. PRESSINGAR, formerly Manager of the Clayton Air Compressor Works, has accepted the position of Secretary and Treasurer of the Pneumatic Supply and Equipment Company, with headquarters at 120 Liberty street, New York.

THE Brattleboro (Vt.) Gas Light Company, through its Board of Directors, has made the positive announcement, through the medium of the advertising columns of the local press, that neither the Company nor anyone in its interest has attempted to buy any of the stock of the Brattleboro Street Railway Company, nor does it wish to buy any for any purpose whatever.

AMONGST other work that the Economical Gas Works Construction Company, of Toronto, Can., has on hand is a contract for important extensions to the coal gas plant of the Stratford (Ont.) Gas Company. New scrubbers, condensers, purifiers, an exhauster and governor have been arranged for. The business of the Stratford Company is growing at a remarkable rate.

A CORRESPONDENT at Johnstown, Pa., forwards the following: "The Consumers Gas Company, of this city, has engaged Messrs. Baxter & Young, of Detroit, Mich., to prepare complete plans and specifications for a complete new coal gas plant, of a daily capacity of 500,000 cubic feet. A holder of 500,000 cubic feet is called for in the plans. Messrs. Baxter & Young will have charge of erecting the plant. The works are to be erected on ground lately acquired by the Gas Company, situated alongside the Pennsylvania Railroad, at a point about one mile distant from the site of the present plant. The latter includes but a double set of water gas apparatus, which will be removed to the present site upon the completion of the new works. Thus it will be seen that the old site is to be altogether abandoned. The demands of the Company's consumers have reached the limit of the capacity of the existing works, and the instruction of the Gas Company to Messrs. Baxter & Young is to build a modern and complete plant."

MR. JOHN H. COWING, after many years of active and honorable connection with the gas interests of Buffalo, N. Y., has resigned the position of General Manager to the Buffalo City Gas Company. No General Manager will be appointed to succeed him, as the Company's President (Mr. A. C. Humphreys) will likely take up the work where Mr. Cowing laid it down.

WE are indebted to a correspondent at New Britain, Conn., for a copy of Secretary Mansfield's announcement respecting the gas rates recently determined by the Middletown (Conn.) Gas Light Company. The announcement is: "Notice is hereby given that the Middletown Gas Light Company, commencing June 1st, will reduce the price of gas for lighting purposes from $1.90 to $1.60 per 1,000 cubic feet, with a discount of 10 cents per 1,000 feet for prompt payment, which brings the net price to $1.50 per 1,000 feet on all bills, provided they are paid within 10 days. The terms above given, together with our price for fuel purposes, at $1.40 per 1,000 feet, are lower than any other city of this size in the State; and the Company hopes by this reduction to induce the more general use of gas by the citizens. As a further inducement to the more general use of gas, where there is no gas in the house, we will put in a service free of expense."

THE Providence (R. I.) Gas Company, as before noted in the JOURNAL, will make important additions to its plant this season, and in connection therewith we are informed that the Berlin Iron Bridge Company has been awarded contracts for the construction of the following buildings: A meter house, 65 feet in width and 110 feet in length; a purifying house, 40 feet in width, 175 feet in length and three stories high; and a holder-covering house, 184 feet in diameter. The entire construction will be of steel framework, to secure as near an approach to fireproofing as possible.

THE results of the appointment of Mr. C. F. Smith to the Superintendency of the Lebanon (Pa.) Gas Company (he assumed the post in 1894) are quite satisfactory to his employers. He works in entire accord with Secretary-Treasurer Mish, and between them President Weimer has had the pleasant task of announcing to the proprietors that the business all round is putting good money in their purses.

AT the annual meeting of the shareholders in the Westerly (R. I.) Gas and Electric Company, the Directors elected were: Edwin Babcock, William Segar, A. L. Chester, Geo. H. Utter and H. H. Babcock.

AT the annual meeting of the Hudson County Gas Light Company, of Hoboken, N. J., the following Directors were elected: S. B. Dod, C. Zabriskie, M. Tierney, R. L. Stevens, Hamilton Wallis, Wm. Sierck and Wm. Shippen.

IT is said that the next semi-annual dividend of the Baltimore Consolidated Gas Company will be at the rate of 2 per cent. Holders of shares in this Company should not allow themselves to be frightened out of their stock by any such move, for those acquainted with the situation there are inclined to the belief that the Company has earned during the last half year a sum sufficient to pay at least 2½ per cent. on its capital.

AT the annual meetings of the Freehold Gas Company and of the Freehold Electric Light Company of Freehold, N. J., the following officers were named to direct the affairs of both concerns: President, H. V. M. Dennis; Vice-President, D. V. Perrine; Secretary and Treasurer, Chas. H. Butcher.

THE Company supplying gas to the towns of Webster and Dudley, Mass. (the Webster Electric Company) has ordered the following selling rate schedule to prevail until further notice: On illuminating account, $2 per 1,000; for fuel use, $1.50 per 1,000. In either instance prompt payment—within 10 days—entitles the user to a rebate of 5 per cent. on the face of the account.

A MEETING of the shareholders in the Conshohocken (Pa.) Gas and Water Company has been called for June 26th, to decide whether or not the capital shall be increased.

THE United Gas Improvement Company has been awarded a contract for the erection of a complete, new gas works for the Peekskill (N. Y.) Gas Company. The works, as before remarked in the JOURNAL, will be located close to the east bank of the Hudson river, and near the tracks of the Hudson River Railroad, thus insuring excellent facilities for the reception of material, etc. The agreement between the contracting parties calls for the installation of a standard, double superheater Lowe water gas apparatus, together with purifiers, exhauster, station meter, relief and storage holders, storage oil tank and all auxiliary parts.

MRS. HELEN ARMSTRONG completed, on the 6th inst., a very successful series of lectures on cooking by gas, under the auspices of the Gas Light Company of Columbus, Ga. The demonstrations were made at 3 P.M. of the first six days of May, and the lecture hall was the dining room of the Central Hotel. The lecturess performed her work well, and she had the incentive to act her best that comes from large and enthusiastic audiences. A feature of the series was the presentation to the holder of the winning coupon of a handsome gas range—each time one attended a lecture a numbered coupon was handed the visitor. The award was made by means of a drawing at the close of the final lecture. To show that the Company did not make halves of the award, it agreed to set the range and to make all the necessary pipe connections without charge. The proprietors of the Company and it wide awake Superintendent, Mr. James Ferrier, are well pleased over the results that attended the lectures and as to the prospects of their bringing still greater reward.

IN furthering the use of gas for fuel in Columbus, Mr. Ferrier has been authorized to announce the following reduced rates, which went into effect the 1st inst.:

Monthly Consumption.	Per 1,000 Cu. Ft. Net.
Under 3,000 cubic feet	$1.25
3,000 cubic feet and under 5,000 cubic feet	1.15
5,000 cubic feet and over	1.10

THE Bronx Gas and Electric Company, Westchester, N. Y., has awarded a contract to the United Gas Improvement Company for a second set of standard, double superheater Lowe water gas apparatus, to have a daily capacity of 250,000 cubic feet. The largely increased demand for gas in the Bronx Company's district obliged it to order this extension.

THE following advertisements, which explain themselves, are plainly indicative of the fact that the syndicate proposing to re-finance the Washington (D. C.) Gas Light Company will encounter serious opposition. Advertisement No. 1 (it originally appeared in the Philadelphia *Public Ledger*) reads: "A number of stockholders in the Washington (D. C.) Gas Light Company who are opposed to the omission of the dividend for the quarter just closed, and also to the proposed scheme for the sale of the stock of the Company, ask other stockholders who are like minded to send their names, addresses and number of shares held by them to John H. Minds, Esq, Gerard Building, Phila., Pa."

The second advertisement (it also appeared in the *Public Ledger*, dated the 8th inst.), reads: "To the stockholders of the Washington (D. C.) Gas Light Company: The character and number of the responses received to my previous advertisement show that the withholding by the directors from the stockholders, for the benefit of a prospective purchaser, the dividend earned in the quarter just passed, and the proposition to sell to the prospective purchaser the stockholdings of the stockholders at a price—paid in instalments—lower than at which it recently sold in the open market for cash will be stubbornly resisted. Those stockholders who have not yet communicated with me will but serve their own interest by doing so immediately. John H. Minds, Esq., Girard Building, Phila., Pa.

AT the annual meeting of the Cincinnati Gas Light and Coke Company the following Directors were elected: A. Hickenlooper, W. A. Goodman, R. Allison, A. Howard Hinkle, George N. Stone, Joseph Bates and J. T. Carew. The annual statement showed that the Company's standing was never stronger, and that its business was steadily increasing. The Directors subsequently perfected the following executive organization: President, General A. Hickenlooper; Vice-President, Norman G. Kenan; Secretary, Henry W. Sage; Treasurer, Chas. J. Foust.

C. D. JONES, of Independence, Ia., and J. J. Rose, of Marshalltown, Ia., are endeavoring to secure a franchise for the operation of a gas plant at Boone, Ia. The franchise granted a year or so ago for a gas works at this point to Mr. J. G. Holmes expires by limitation August 1st, 1899, and it is likely to lapse. At any rate no work to preserve the grant has thus far been done.

AT the annual meeting of the Pottstown (Pa.) Gas Company the election resulted in the naming of the following officers: Directors, J. E. Porter, W. H. Smith, Jacob S. Bahr, M. Burr Casselberry, S. H. Porter, W. H. Young, Fred. W. Van Buskirk, W. G. Kehl and L. G. Lefever; President, J. Elmer Porter; Secretary, J. S. Bahr; Treasurer, W. H. Smith; Superintendent, S. L. Cramer.

THE proprietors of the Hackensack (N. J.) Gas and Electric Company have made a sensible reduction in the selling schedule, so far as the same applies to its gas trade. The gross figure remains at $2 per 1,000, but the discounts have been so adjusted that hereafter users will pay these net rates, prompt payment securing the advantage: Up to 3,000 cubic feet per month, $1.80; 3,000 to 6,000 per month, $1.70; over 6,000 per month, $1.50—per 1,000, of course.

THE Bethlehem (Pa.) Gas Company has been sold to a syndicate, represented by Messrs. Edward C. Jones & Co., of this city, at a price equivalent to three times the par value of its stock.

THE new proprietors of the Easton (Pa.) Gas Company have formally assumed control of their purchase. The officers chosen are: Directors, A. E. Childs, Alfred Clarke and George Blake, Boston, Mass.; S. C. Smith, Phillipsburg, N. J.; and M. H. Jones, James W. Wilson, J. M. Porter, E. J. Fox and J. W. Fox, of Easton; President, M. H. Jones; Vice-President and Treasurer, Arthur E. Childs; Secretary, Jas. W. Fox; General Manager, Alfred Clarke. With much satisfaction we further report that Mr. W. H. Ward is to be continued as Superintendent. The Directors also adopted the following resolution:

"*Resolved*, That the Directors of the Easton Gas Company desire to record this expression of their appreciation of the fidelity and care which the retiring Directors exercised in the management of the affairs of the Company."

AT the annual meeting of the shareholders in the Detroit City Gas Company, the officers chosen were: Directors, John Byrne, J. C. Donnelly, W. F. Douthirt, D. M. Ferry, Thos. H. Hubbard, C. P. Huntington, E. T. Lynch, W. C. McMillan, M. W. O'Brien, Emerson McMillin, Geo. H. Russell, F. S. Smith and W. H. Wells; President, Emerson McMillin; Vice-President, W. C. McMillan; Secretary, J. C. Donnelly; Treasurer, M. W. O'Brien.

THE United Gas Improvement Company has issued the following ukase, in the instance of its outdoor employees: "The Company in-

(*Continued on page* 736.)

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

THOS. J. CUNNINGHAM,
ELBERT P. CALLENDER,
EDITORS.

CHAS. E. SANDERSON,
MANAGER.

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MONDAY, MAY 15, 1899.

(*Continued from page* 735.)

tends to have its workmen on the streets wear uniforms For the men in the main and service departments these uniforms will consist of white canvas coat and trousers, a soft canvas hat, and a shirt or jersey of dark blue. The cost of coat, trousers, hat and jersey will be about $3. For the men in the fitting department and the drivers a stiff or helmet-shaped hat will be used instead of the soft hat. The cost of the suit with the stiff hat will be about $4. Each workman will be required to wear a clean suit when he begins work each Monday morning; therefore he will probably have to keep two suits in stock at one time. The workmen will obtain their suits at a place to be designated by the Company, and will pay cash for them. The suits will probably be ready for distribution in about one month. This notice is given in advance to enable the workmen to provide, without inconvenience, the necessary cash to pay for the uniforms." So much for the summer season.

THE Jackson (Miss.) Electric Light, Power and Street Railroad Company has absorbed the plant and franchises of the Jackson Gas and Electric Light Company; and Mr. Samuel Carnes has assumed the duties of Manager of the combined enterprise. The first move made by the Manager was to put the selling rate on illuminating account at $2.25 per 1,000, and the fuel rate was fixed at $1.75. The prior rate was $3 "all around."

AT the annual meeting of the Altoona (Pa.) Gas Company these officers were chosen: Managers, John Lloyd, H. C. Dern, T. Blair Patton, Jno. R. Bingaman, A. C. Shand and W. C. Lut; President, John Lloyd; Treasurer, J. A. Ritchey.

A CORRESPONDENT forwards the following: "The reception and oyster roast given by the Berlin Iron Bridge Company, of East Berlin, Conn., each year to its employees and friends, has now become as fixed a feature of this concern as its annual stockholders' meeting, and we venture to say that no other concern in the world makes as much preparation for such annual *fete*, or provides with so liberal hand as it does for such an event. While these annuals are professedly for their employees and their families, to bring employers and employees into closer touch with each other, the invitations are sent broadcast over the State, and so deservedly noted have they become that it is esteemed a great privilege to be the recipient of an invitation to be one of its guests. There were 2,500 invitations sent out, and by the numbers present it would almost seem that everyone invited had brought along his friend. Had they brought two friends the welcome would have been none the less royal. As early as 4 o'clock the guests began to arrive, and until 8 the stream of arrivals was unbroken till there were estimated 4,000 people present. The B.I.B. Company full band furnished music, the template department had been cleared and turned into a ball room, where hundreds of couples whirled through the maze of a lengthy programme of select dances. The new shop was transformed into a vast dining parlor, where the steaming bivalves were turned from the huge pans onto innumerable tables, where, with crackers, butter and fragrant coffee, the thousands partook. The entire plant, from the President's private office to the uttermost parts of its acres of great factories and grounds, was thrown wide open for the freedom of all, and every foot of it was packed with a moving throng of delighted people, viewing the sights and regaling themselves with the entertainment provided with such generosity. It is simply impossible to enter into the particulars that would convey to a person not being there any conception of the preparations made, or the splendid manner in which even the smallest detail had been arranged for their pleasure, that no one might be overlooked. The officers of the Company, with their several capable superintendents, foremen and committees, were everywhere—receiving, directing and extending welcomes, they seemed to know everyone, where he was from and what he wanted. It was a gigantic undertaking, conducted with a smoothness that drew forth the warmest admirations from thousands who will retain it as one of the most successful and enjoyable events of their lives."

MR. EDWARD H. JENKINS has accepted a position as representative of the gas and electric lighting and street railway interests of San Antonio, Texas. Mr. John T. Herron succeeds Mr. Jenkins for the present as Engineer of the Buffalo (N. Y.) City Gas Company.

The Market for Gas Securities.

The market for city gas shares during the week reflected the uncertainty that prevails at various headquarters over the result of the operations going on "at the front." The bush whacking continues, and all sorts of prices are being offered as inducements for consumers to make a change. Another feature of the week was the adoption by the Municipal Assembly of a resolution placing the price of gas in the entire city at 75 cents per 1,000 cubic feet, which movement may be looked upon in the light of poses that obtain in kindergarten calisthenics. It might be though that some of the gentlemen concerned in the Brooklyn Union Gas Company would regard the ordinance with disfavor. Consolidated opened to day (Friday) at 184 to 185½, and towards noon sales at the former figure were recorded. Amsterdams are nominally somewhat stronger than last week, and Mutual remains unchanged.

Standard common is somewhat lower, but the preferred holds up well. At its annual meeting Mr. Ferdinand McKeige was retired from the directory, and Major McAlpin was named to succeed his father, who retires from official connection with the Company with the hearty respect of everybody interested in it. A still further amusing feature of the week was the statement made by Mr. Benedict's man Hastings, that the New Amsterdam's ownership in the Kern gas burner (the Company to exploit which is capitalized just one million short of the "common" of the Amsterdam) is about to end the gas war—the burner is so extremely valuable, in that it is to cut down the consumption one-half while doubling the illumination from the half used. Hastings and his friend, if we mistake not, had something to do three years ago in seeing to it that the old Equitable Company got all there was in the "rights" for the use in this city of calcium carbide, so far as the same could be employed as an enricher.

Brooklyn Union is 143 bid, ex-dividend of 3 per cent.; Peoples, of Chicago, on which a quarterly dividend of 1½ per cent. has been declared, is 121 bid; Bay State is 3⅛ to 3¼; Peoples, of Jersey City, is 215 bid—it is worth 250—and Baltimore Consolidated is 65½ to 66. Cincinnati gas, owing to the proposed opposition movement, dropped to 185. Considerable opposition has been developed to the plan suggested for the refinancing of the Washington (D. C.) Company.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

May 15.

☞ All communications will receive particular attention
☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$39,078,000	100	184	185½
Central Union, Bonds, 5's.	3,000,000	1,000	107½	108½
Equitable Bonds, 6's	1,000,000	1,000	105	.
" 1st Con. 5's	2,300,000	1,000	115	118
Metropolitan Bonds	658,000	.	108	112
Mutual	3,500,000	100	300	330
" Bonds	1,500,000	1,000	100	102
Municipal Bonds	750,000	.	..	
New Amsterdam Gas Co.	13,000,000	100	35¾	36
Preferred	10,000,000	100	62	63
Bonds, 5's	11,000,000	1,000	100½	101
Northern Union, Bonds, 5's.	1,250,000	1,000	95	97
New York and East River..				
Bonds 1st 5's	3,500,000	1,000	109	111
" 1st Con. 5's	1,500,000	..	112	114
Richmond Co., S. I.	348,650	50	70	..
" Bonds	100,000	1,000	..	..
Standard	5,000,000	100	135	135
Preferred	5,000,000	100	145	155
Bonds, 1st Mortgage, 5's	1,500,000	1,000	112	114
Yonkers	299,65	500	130	..
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	143x	..
" " Bonds (5's)	15 000,000	1,000	118	119
Bay State	50,000,000	50	3	3⅛
" Income Bonds	2,000,000	1,000	..	75
Binghamton Gas Works..	450,000	100	40	..
" 1st Mtg. 5's	450,000	1,000	95	98
Boston United Gas Co.—				
1s Series S. F. Trust	7,000,000	1,000	92	..
2d " " "	3,000,000	1,000	68	71
Buffalo City Gas Co.	5,500,000	100	12	14
" " Bonds, 5's	5,250,000	1,000	89	91
Central, San Francisco	2,000,000	..	105	..
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	104¼

Columbus	1,144,700	100	70	75
1st Mortgage	1,207,000	1,000	106	108
Consumers. Jersey City	2,000,000	100	88	..
" Bonds	600,000	1,000	102	105
Cincinnati G. & C. Co.	8,500,000	100	194	195
Consumers, Toronto	1,700,000	50	230	235
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000		
Consolidated, Baltimore	11,000,000	100	65⅛	66
Mortgage, 6's	3,600,000	..	..	118
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N.J.	1,000,000	100	23	25
" Con. Mtg. 5's	380,000	1,000	80	82
Consolidated G. & E. Co.'s., Little Falls, N.Y.	90,000	100	..	100
Bonds	75,000	..	..	100
Detroit City Gas Co	4,560,000	50	65	65⅛
" Prior Lien 5's	4,546,000	1,000	94¼	94½
Detroit Gas Co., 5's	423,000	1,000	95½	96
" Inc. 5's	31,000	100	..	..
quitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Fort Wayne	2,000,000	..	62	65
" Bonds	2,000,000	..	80	85
Grand Rapids Gas Lt. Co.	1,000,000	50	..	..
" 1st Mtg. 5's	1,125,000	1,000	..	.
Hartford	750,000	25	..	145
Indianapolis	2,000,000	..	122	128
" Bonds, 6's	2 650,000	..	105	106
Jackson Gas Co	250,000	50	..	..
" 1st Mtg. 5's	250,000	1,000	..	..
Jersey City	750,000	20	225	275
Lafayette Gas Co., Ind	1,000,000	100	68	70
Bonds	1,000,000	1,000	81	86
Louisville	2,570,000	50	106	108
Laclede, St. Louis	7,500,000	100	53¼	53½
Preferred	2,500,000	100	100	103
Bonds	10,000,000	1,000	107	108
Madison Gas & Elec. Co.	400,000	100	68	70
" 1st Mtg. 6's	350,000	1,000	102	..
Montreal, Canada	2,000,000	100	200	..
Newark, N. J., Gas Co	1,000,000	..	200	220
Bonds, 6's	4,000,000	..	128	130x
New Haven	1,000,000	25	280	300
Nashville Gas Lt. Co.	1,000,000	50	110	..
Oakland, Cal.	2,000,000	..	53½	55
" Bonds	750,000	..	..	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	120⅞	121
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,00	1,000	111½	112
2d "	2,500.000	1,000	104	105
Peoples, Jersey City	500,000	50	215	..
Rochester Gas & Elec. Co.	2,150,000	50	52	..
Preferred	2,150,000	50	103	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	10,000,000	100	74	75
St. Paul Gas Light Co	1,500,000	100	50	52
1st Mortgage 6's	650,000	1,000	82	85
Extension, 6's	600,000	1,000	..	..
General Mortgage, 5's	2,428,000	1,000	80	82
St. Joseph Gas Co	1,000,000	100	..	..
" 1st Mtg. 5's	750,000	1,000	.	..
Syracuse, N. Y.	1,750,000	100	16	19
Bonds	1,612 000	1,000	85	89
Washington, D. C	2,600,000	20	292½	293
First mortgage 6's	600,000	..	..	..
Western, Milwaukee	4,000,000	100	97	97¾
Bonds, 5's	3,830,500	.	106	108
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As Superintendent or Manager of a Gas Property

in a city of from 5,000 to 20,000 population. Has had 12 years' experience in both coal and water gas works. Has been successful in increasing business. Would invest some money in a good place. References exchanged.

1249-3 Address "M.." care this Journal.

Position Wanted

As Superintendent or Assistant Superintendent of Gas Works,

By a young man well experienced in the manufacture and distribution of gas. Can furnish references.

1248-2 Address "O. K.," care this Journal.

WANTED,

An Energetic Gas and Electrical Manager

would like to correspond with some Company contemplating change of management, well versed in all branches of construction work. Address

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Position Wanted.

On account of changes made in my present Company, I will eever my connection therewith on February 20, and solicit correspondence with Gas Companies contemplating a change of management. Eight years with present Company. References. E. G. HOLZER, Supt. Gas Dept.,

1238-tf Roanoke Gas and Water Co., Roanoke, Va.

WANTED,

A 5-Foot or 10-Foot Meter Prover.

Will repair meters in exchange or pay cash. State price and make. Address

"L. P. C., care Weinberger's Hotel,

1249 Indianapolis, Ind.

WANTED.

A Second-Hand Station Meter for Coal Gas Works.

Capacity, 80,000 cubic feet per 24 hours. Meter to have 8-in. connections. Address

GALION GAS LIGHT CO.,

1249-1 Galion, Ohio.

FOR SALE.

The Entire Ironwork of a Lowe Junior Set,

consisting of Generator 4 by 8 feet, and Superheater 4 feet by 14 feet, with their Connecting Pipe, Doors, Purge Valve, Air Valves, Grate Bars, etc., in good order; cheap.

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SECOND-HAND APPARATUS.

I am in position to offer at attractive prices, a considerable quantity of good, usable second-hand Gas Apparatus, of various kinds and sizes, such as Purifiers, Station Meters, Exhausters, Scrubbers and Condensers, Bench Ironwork, Water Gas Machinery, Tanks, etc., etc. Gas Companies or Contractors who can use such will find it worth while to write for prices, stating their requirements. Gas Companies having apparatus to dispose of are invited to communicate upon the matter. F. H. SHELTON,

315 Fidelity Building, 112 N. Broad St., Phila.

We give you

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perfect Lava Tips with every Gross you buy.

"A CEASAR COULD DO NO MORE."

Gas Companies should insist upon getting the Best.

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The D. M. Steward Mfg. Co.,

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A Small Gas and Electric Light Plant,

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Utilize Your Gas Liquor.

NO EXTRA LABOR OR OPERATING EXPENSES.

Ammonia Concentrator.

Not Expensive. Write to STROH & OSIUS, Pat'ees, or Mich. Ammonia Works. Detroit. Mich.

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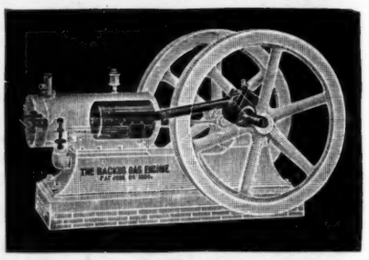

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Agts. { Chicago Water Motor & Fan Co., 101 Lake St., Chicago. Michell & Co., - - 154 Congress Street, Boston, Mass.

Home Office, **Backus Water Motor Co.**, Newark, N. J.

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Are Used in every Country in the World.

Owing to the steadily increasing demand year by year, additions to factory and plant have been constantly made, resulting in the largest and best equipped Burner plant in the world. Burners are made for all pressures and conditions. There is but one "BRAY" Burner. Accept no imitation. Write for our new Pamphlet.

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With Bray Burner.

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For Shutting Off Gas in Mains Temporarily during Alterations or Repairs.

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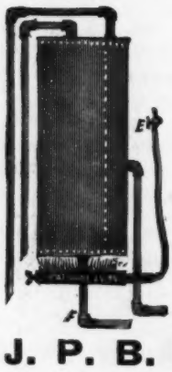

PERFECT COMBUSTION. NO SMOKE. NO ODOR.

FULLY GUARANTEED.

Will heat the Water in a Boiler in less than half the time required by a Range, and at less than half the expense. Nothing to get out of order, and will last a lifetime.

BUFFALO CITY GAS CO., BUFFALO, N.Y., April 1, 1899.

J. P. B. SADTLER & Co., 813 S. Howard St., Baltimore, Md.

Gentlemen—Replying to your favor of the 30th of March. The Heller Heaters that you have already furnished seem to be large enough, and we will not at present care to use any of the larger size that you mention. We have had no complaint in regard to the Heller Heater that we have used in Buffalo, and so far they are giving us good satisfaction.

Yours very truly, E. H. JENKINS, Engineer.

BALTIMORE, MD., March 24, 1899.

J. P. B. SADTLER & Co., 813 S. Howard St., Baltimore, Md.

Gentlemen—A test of the Heller Water Heater witnessed by me March 21, 1899, showed that with a consumption of 30 feet of gas per hour, the water in a 28 gallon galvanized boiler could be heated from 59° to 102°, or 43° in one hour. Temperature of room at time of test 64°.

Respecfully,

GEO. BEADENKOPP, Ass't Engineer, Con. Gas Co.

Clamp Heater to Pipe about 4 Inches away from bottom of Boiler. Always use an independent connection, or regular Gas Stove connection, so as to get a good flow of Gas.

J. P. B. SADTLER & CO., 813 South Howard Street, Baltimore, Md.

W. H. PEARSON, Prest. W. H. PEARSON, Jr., Vice-Prest. J. T. WESTCOTT, M.E., Manager. L. L. MERRIFIELD, M.Inst.M.E., Chief Engineer.

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Telegraphic Address: "CARBURETED LONDON AND TORONTO."

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Saltley Works, Birmingham, Eng.	2,000,000	Kingston, Pa.	125,000
Colchester, Eng.	300,000	Montreal,	500,000
Birkenhead, Eng.	2,250,000	Peterborough, Ont.	250,000
Swindon (New Swindon Gas Co.), Eng.	120,000	Wilkesbarre, Pa.	750,000
Saltley Works, Birmingham, Eng. (2d Contract)	2,000,000	St. Catherine's (Second Contract),	250,000
Windsor Street Works, Birmingham, Eng. (Second Contract),	2,000,000	Buffalo, N. Y.	2,000,000
Halifax, Eng.	1,000,000	Winnipeg, Man.	500,000
Toronto,	250,000	Colchester, Eng. (Second Contract),	300,000
Ottawa,	250,000	York, Eng.	750,000
Toronto (Second Contract, Remodeled),	2,000,000	Rochester, Eng.	500,000
Lindsay (Remodeled),	125,000	Kingston, Ont.	300,000
Belleville,	250,000	Crystal Palace District, Eng.	2,000,000
Ottawa (Second Contract),	250,000	Duluth, Minn.	300,000
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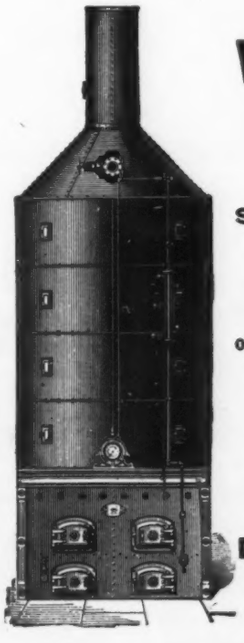

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LARGE-SIZE BOILERS IN STOCK.

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Made in all sizes.

Will cut from 2 in. to 24 in.
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For Cutting Cast, Wrought Iron, Gas & Water Pipes.

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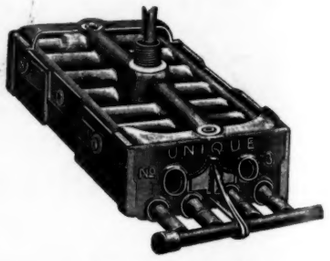
THE QUICKEST WATER HEATER MADE
USING THE SAME AMOUNT OF GAS.

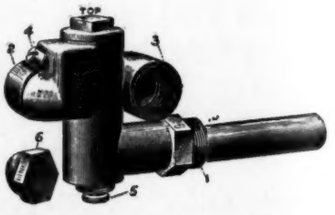
SIMPLE, INEXPENSIVE, EASILY ATTACHED. CAN BE CONNECTED TO A COAL RANGE. NO VALUABLE SPACE IS WASTED, AS IT IS PLACED DIRECTLY UNDER THE BOILER, BETWEEN THE ARMS OF THE STAND.



The Vulcan Thermostat.

While the use of the Vulcan Thermostat is not essential in connection with the Unique Water Heater, when it is so attached the cost of fuel is reduced to a minimum, and perfect satisfaction is secured.

The **VULCAN THERMOSTAT** can be applied to most any Water Heater, and automatically controls the gas supply. With its use there is absolutely no waste of gas.



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We also make the Cheapest and Strongest
REVERSIBLE BOLTED TRAYS IN THE MARKET.
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PRESSURE GAUGE.

For continuous records of **Street Gas Pressure.** Simple in construction, accurate in operation, and low in price.

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Gas, Water, Steam, Oil, Ammonia, Etc.

HOT GAS VALVES A SPECIALTY.

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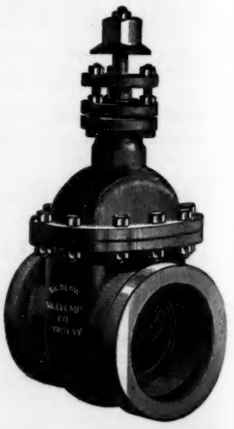

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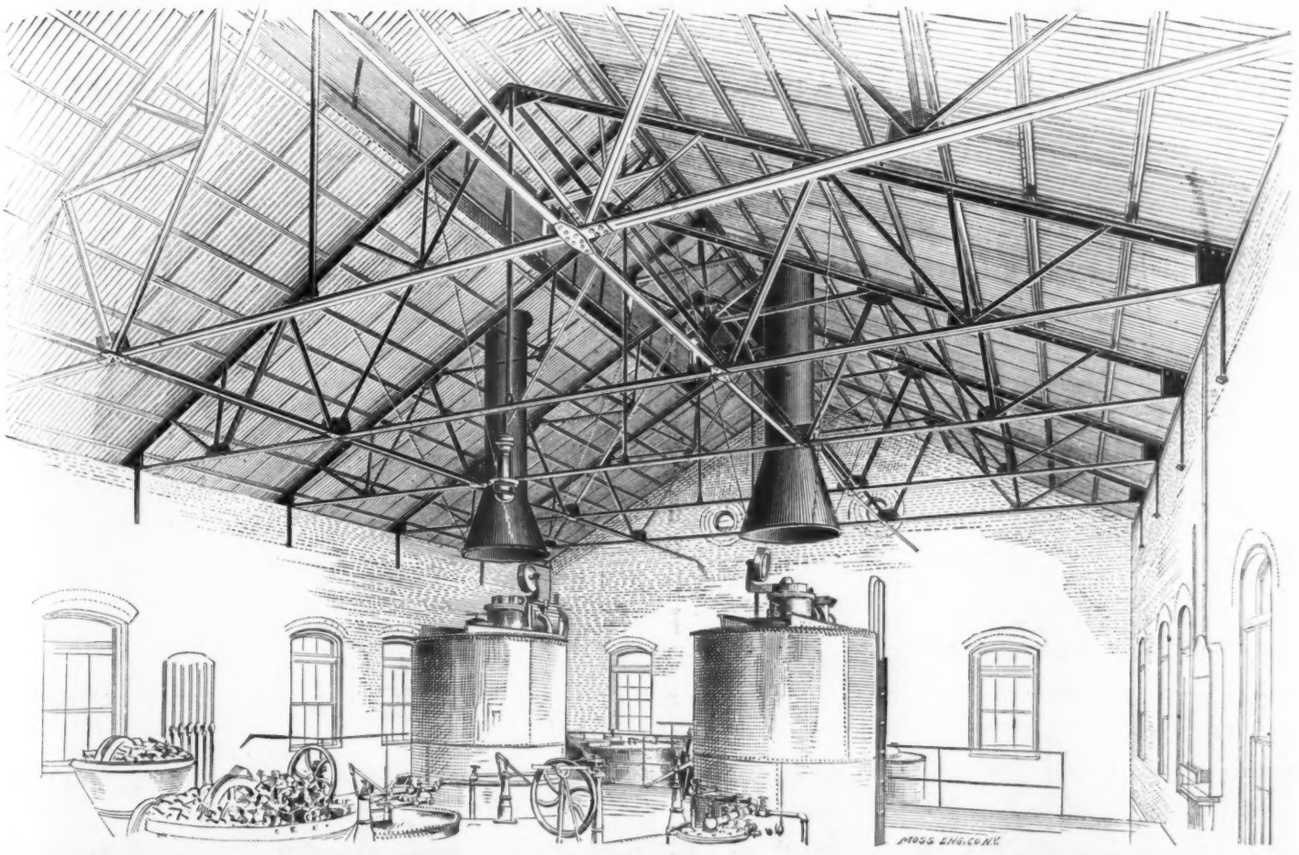

The above illustration is taken direct from a photograph, and shows the construction of an Iron Truss Roof designed and built by us for the Providence Gas Light Company, at Providence, R. I. The building is 40 feet in width by 100 feet in length, the side walls being of brick and the roof being entirely of iron—that is, iron trusses and purlins covered with corrugated iron. The building is ventilated by our Improved Ventilator, extending the full length of the roof, with side shutters opened and closed by cords from the floor. No woodwork is used in any way about the construction of the building.

BOSTON OFFICE, 200 Equitable Building.
NEW YORK OFFICE, 718 Bennet Building, Cor. Fulton and Nassau Streets.
PHILADELPHIA OFFICE, 1215 Stephen Girard Building.

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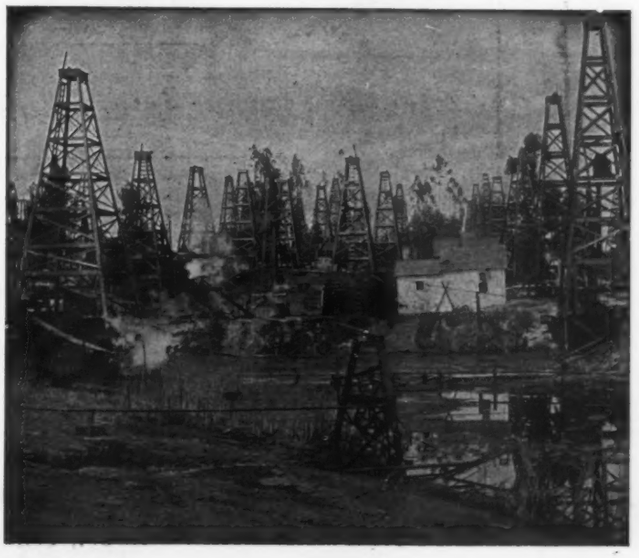
Gas Investments in California.

Nowhere else on this continent does such opportunity exist for profitable gas investment as on the Pacific Coast, since the perfection of the new LOWE Process for using the heavy crude California oils (of which there is an unlimited supply) without the use of any other fuels. Seven years' test proves the system to be perfect in every respect. Los Angeles alone, in addition to present street mains, has 150 miles of well built up streets without a gas main on them. To occupy this territory, and a large number of other towns now without gas, we have organized a parent company and a number of local companies covering some of the fastest growing cities in the United States.

Now is the time to invest, when the first capital will be able to double itself in a single year. This is also the most delightful residence section in the United States.

We suggest to those desiring gas investments, in large or moderate amounts—with or without active business connections—to come here and investigate; or, what is the next best thing, write us for particulars and prospectus.

The accompanying cut shows the oil wells in the suburbs of Los Angeles from which the Companies under the NEW LOWE GAS PROCESS obtain their supply of oil.



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Constructors of Coal Gas Apparatus.

KLONNE-BREDEL

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SOLE UNITED STATES AGENT FOR
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NEW GAS GOVERNOR AND STEAM VALVE.

GUARANTEED TO REGULATE WITHIN ONE-TENTH OF AN INCH, WATER PRESSURE.

The Most Perfect Gas Governor on the Market.

MORE DIRECT IN ACTION. FEWER PARTS.
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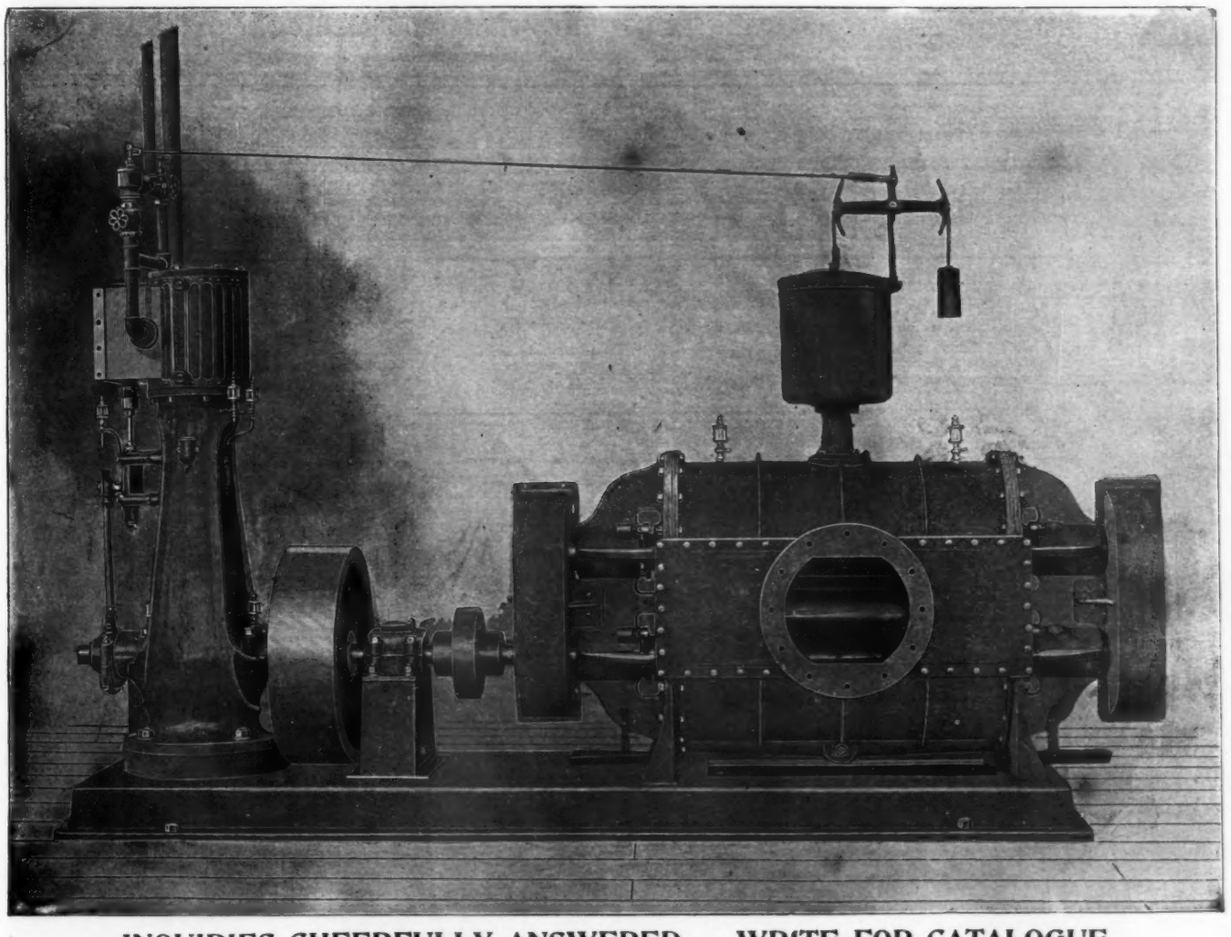

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—OWNS, CONTROLS AND OPERATES—
EXCLUSIVELY

THE NEW IMPROVED AND PATENTED STREET LIGHT BURNER.

STYLE No. 81.

Our PATENTED "STREET LIGHT APPLIANCES" have made WELSBACH STREET LIGHTING a complete success.

By the UNIFORM DISTRIBUTION of light on scientific principles a greater area can be lighted by our system and more economically than in any other way.

Where there are no gas mains already laid, we can furnish an equally good light by our **SELF-GENERATING NAPHTHA WELSBACH BURNER,** enabling Gas Companies to furnish a uniform light in all localities.

Lists of Cities and Towns in which we are now lighting under contract will be furnished upon application.

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With Instructions for Care and Working of the Same.

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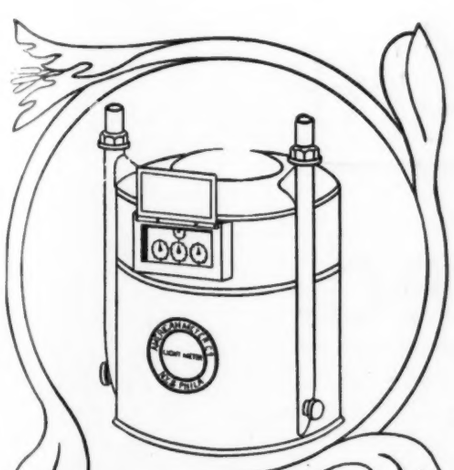

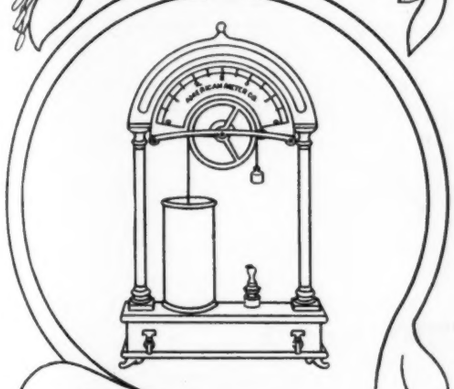

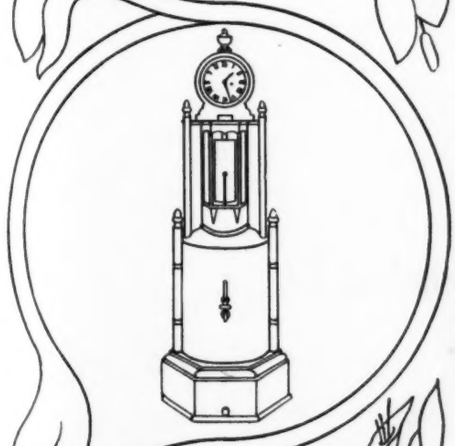

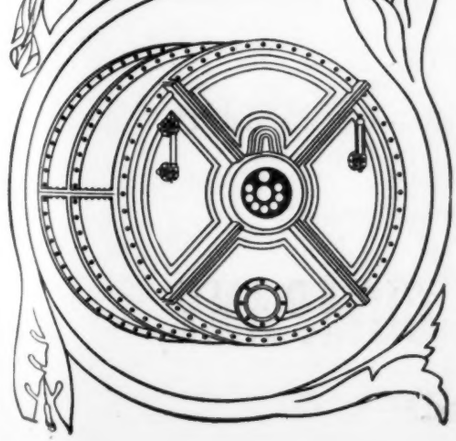

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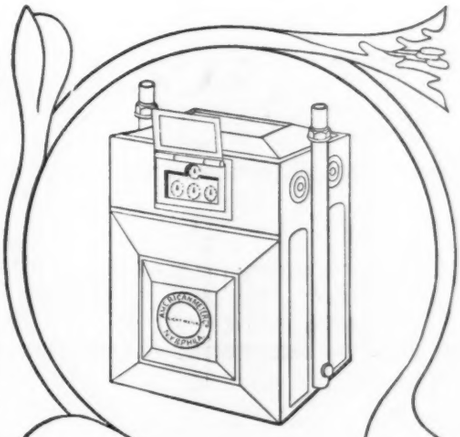

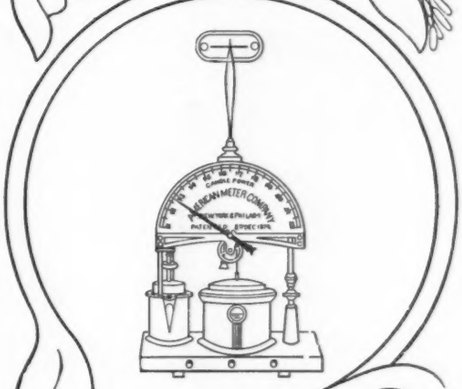

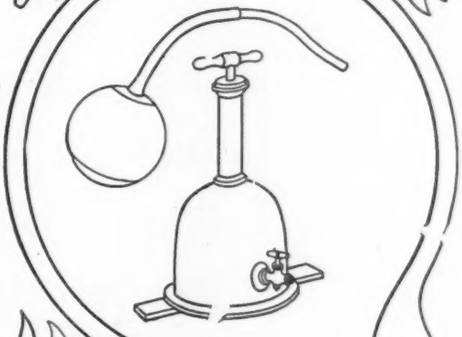

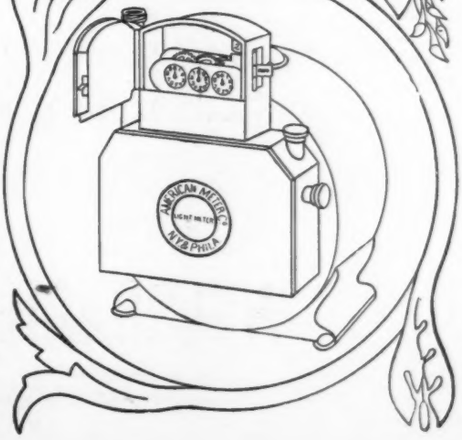

PUBLIC LIGHTING TABLE.

MAY, 1899.

Day of Week.	Table No. 1. Following the Moon. Date.	Light.	Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Extinguish.
				P.M.	A.M.
Mon.	1	7.30 PM	1.40 AM	6.45	4.00
Tue.	2	7.30 LQ	2.20	6.45	4.00
Wed.	3	7.30	2.50	6.45	4.00
Thu.	4	7.30	3.20	6.45	4.00
Fri.	5	7.30	3.40	6.45	4.00
Sat.	6	7.30	3.50	6.45	4.00
Sun.	7	7.30	3.50	6.55	3.40
Mon.	8	7.30	3.50	6.55	3.40
Tue.	9	7.30 NM	3.50	6.55	3.40
Wed.	10	7.30	3.50	6.55	3.40
Thu.	11	7.30	3.50	6.55	3.40
Fri.	12	7.30	3.50	6.55	3.40
Sat.	13	7.30	3.50	6.55	3.40
Sun.	14	10.30	3.40	7.00	3.30
Mon.	15	11.00	3.40	7.00	3.30
Tue.	16	11.20	3.40	7.00	3.30
Wed.	17	11.50 FQ	3.40	7.00	3.30
Thu.	18	12.10 AM	3.40	7.00	3.30
Fri.	19	12.40	3.40	7.00	3.30
Sat.	20	1.10	3.40	7.00	3.30
Sun.	21	1.30	3.40	7.10	3.15
Mon.	22	2.10	3.40	7.10	3.15
Tue.	23	No L.	No L.	7.10	3.15
Wed.	24	No L. FM	No L.	7.10	3.15
Thu.	25	No L.	No L.	7.10	3.15
Fri.	26	7.50 PM	10.10 PM	7.10	3.15
Sat.	27	7.50	11.00	7.10	3.15
Sun.	28	7.50	11.40	7.15	3.15
Mon.	29	7.50	12.20 AM	7.15	3.15
Tue.	30	7.50	12.50	7.15	3.15
Wed.	31	7.50 LQ	1.20	7.15	3.15

TOTAL HOURS LIGHTING DURING 1899.

By Table No. 1.	Hrs.Min.	By Table No. 2.	Hrs.Min.
January	215.40	January	423.20
February	184.40	February	355.25
March	187.40	March	355.35
April	166.50	April	298.50
May	158.00	May	264.50
June	140.50	June	234.25
July	150.30	July	243.45
August	168.30	August	280.25
September	179.50	September	321.15
October	213.20	October	374.30
November	217.00	November	401.40
December	238.10	December	433.45
Total, yr.	2221.00	Total, yr.	3987.45

Welsbach Patent Again Sustained.

Following the recent decision in the United States Circuit Court of Appeals, sustaining Welsbach Company's Patent, Judge Lacombe, in the United States Circuit Court, has enjoined the following manufacturers and sellers:

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Adrian, Mich.	1	125,000 "
Concord, N. H.	1	400,000 "
Sioux City, Iowa	1	750,000 "
Standard Gas Light Co., New York	3	5,400,000 "
Peekskill, N. Y.	1	250,000 "
Westchester, N. Y.	1	250,000 "
Jersey City, N. J.	1	1,000,000 "
Total	14	10,625,000 "
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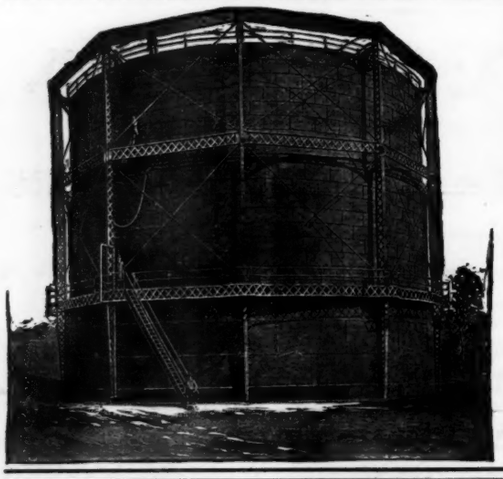

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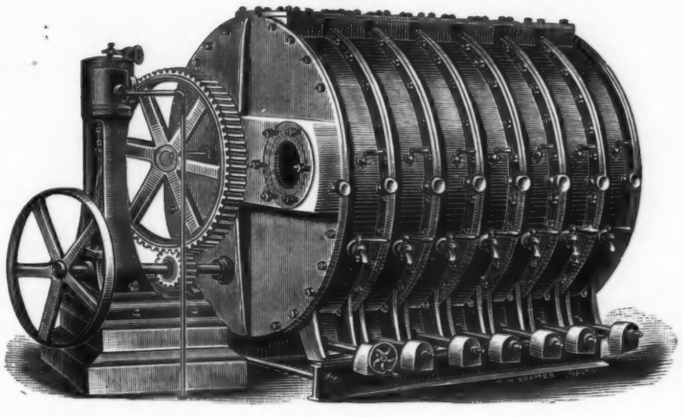

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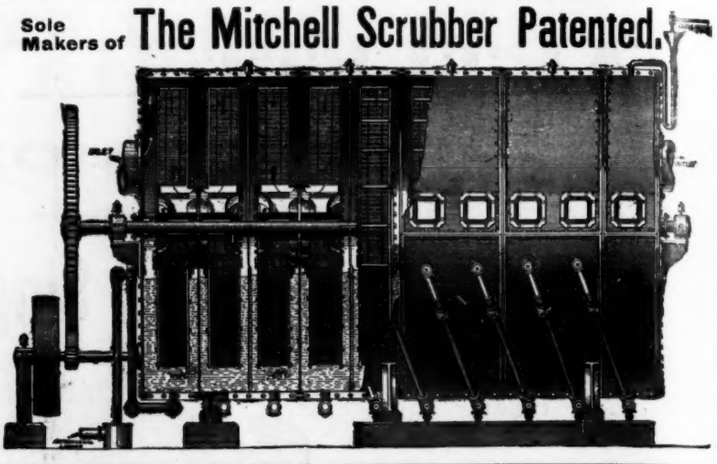

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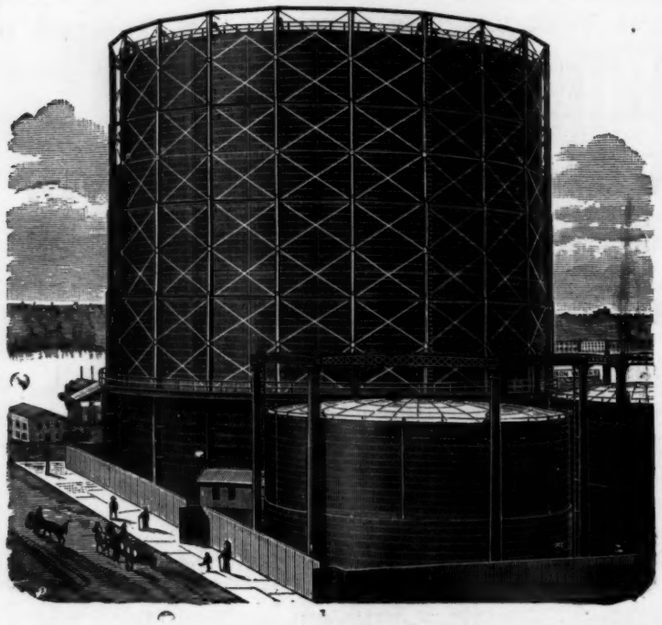

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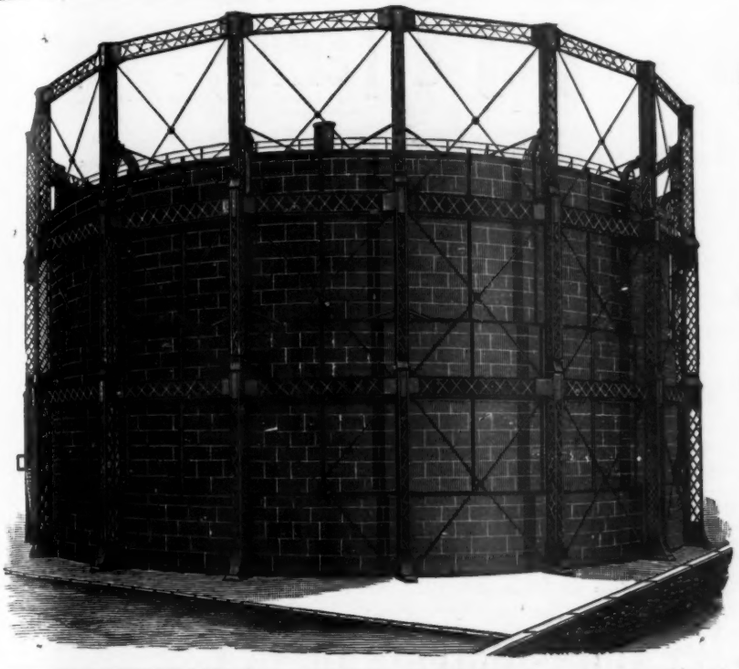

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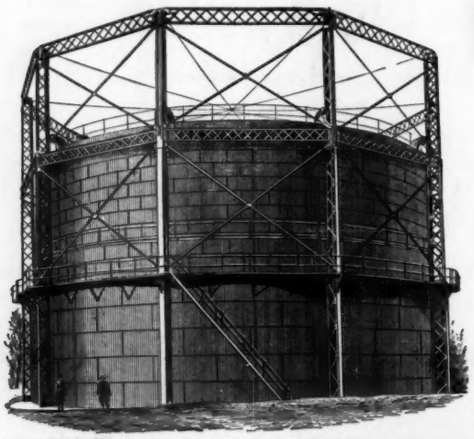

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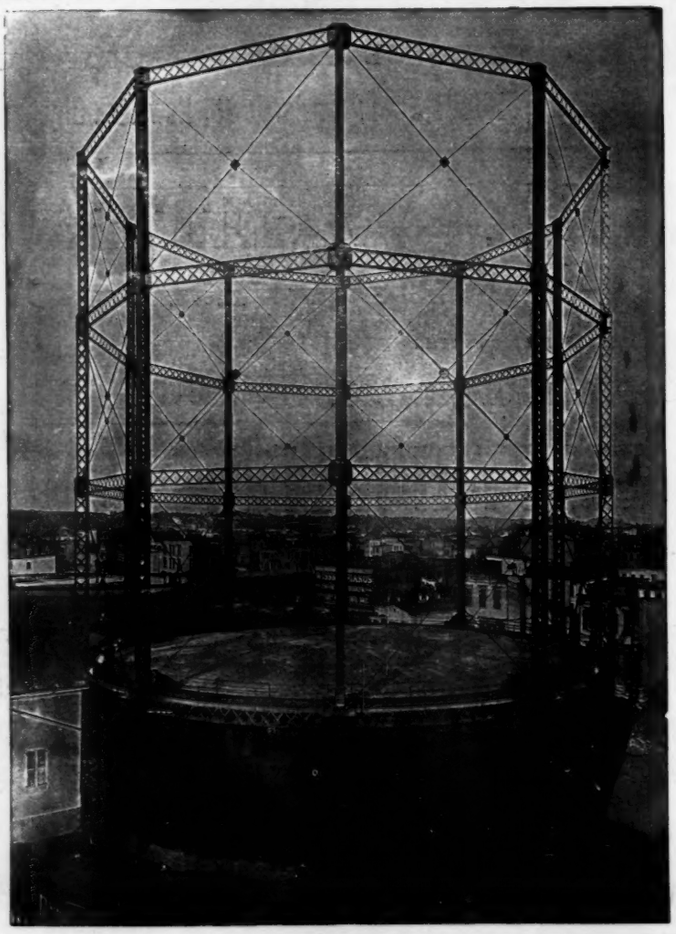

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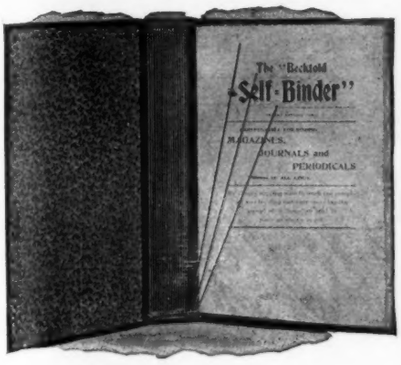

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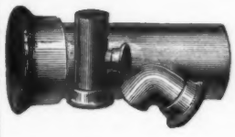

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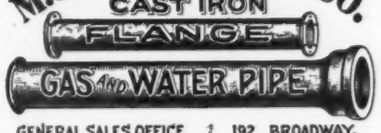

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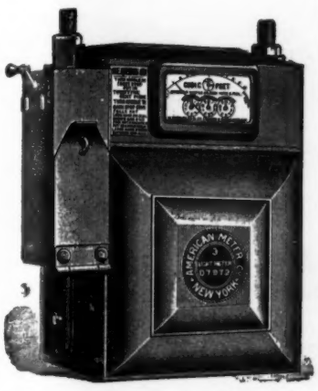

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